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Exploring Dual Credit Data Alignment, Student Populations, and Coursework Patterns in Texas Using a P-16 Framework

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Exploring Dual Credit Data Alignment, Student Populations, and Coursework Patterns in Texas Using a P-16 Framework

by

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Dedication

This dissertation is dedicated to my husband, children, and parents –

For their support of my dreams and the sacrifices they

have made to help me achieve them

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Exploring Dual Credit Data Alignment, Student Populations,

and Coursework Patterns in Texas

Using a P-16 Framework

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This multi-faceted study of dual credit programs in Texas was motivated by perceived discrepancies in dual credit data reporting and a lack of comprehensive, state-level information about dual credit student populations and coursework patterns. Using a P-16 framework, the author explored alignment issues that influence the delivery of dual credit programs and the tracking of dual credit participants in Texas. A review of dual credit partnership agreements between high schools and colleges, an analysis of dual credit course crosswalks, interviews with secondary and postsecondary dual credit coordinators, and a cross-agency analysis of state-level dual credit data provided insight into data and program alignment concerns.

These research efforts informed the construction of a database of 2004-2007 Texas public high school graduates who took dual credit courses while in high school. Demographic differences and college outcomes were analyzed for the full cohort and cohort subpopulations. Two ANOVAs were used to explore differences in the number of dual credit courses students took and freshman college GPA by several demographic and outcome variables. Study results showed regional differences in dual credit coursetaking patterns and differences in student populations who took academic dual credit courses,

non-academic dual credit courses, and both types of courses. Longitudinal data revealed differences in dual credit coursetaking populations over time, including growth in the number of economically disadvantaged and underrepresented minority students who took advantage of dual credit opportunities.

Study findings emphasized the value of improving dual credit data reporting and course alignment practices. Important state-level goals were identified as ensuring: that students have access to rigorous, quality programs; that educators and policy-makers have access to accurate data; and that dual credit partnerships maintain the flexibility to innovate and respond to student needs while preserving program quality and equity.

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CHAPTER ONE: INTRODUCTION

Background

Over the last several decades, the United States has been shifting from an industrial to a knowledge-based economy. In addition to changing workforce needs, the country's demographic profile has altered. American public educational systems have long been recognized as pathways for improving economic strength, increasing social cohesiveness, and supporting personal opportunity. However, the changing economic and demographic landscape has put pressure on schools to re-examine their effectiveness in meeting these generally acknowledged objectives. National leaders and policy-makers believe that America's educational systems must close performance gaps and improve overall outcomes if the U.S. is to successfully compete globally and prepare its citizens to participate effectively in a progressively more diverse and complex democracy (Van de Water & Rainwater, 2001). Policy-makers are increasingly choosing to address the difficult educational challenges ahead by adopting P-16 (preschool through college) approaches to educational reform. As these approaches gain momentum, policy-makers must evaluate whether the P-16 model and the reforms generated within this conceptual framework have the scope, flexibility, and influence to stimulate large-scale, sustainable change.

Despite their common purpose of providing education, the major educational systems in the United States – preschool, K-12, and higher education – have traditionally been viewed as autonomous entities with separate and substantially different governance structures and missions. The P-16 approach focuses on improving alignment within and among the three major educational systems to provide a better, more cohesive educational experience for the students who move through them. The P-16 umbrella frames and supports varied initiatives that span all or parts of the educational spectrum. One area that receives considerable attention is the transition from high school to college. P-16 proponents argue that by better aligning K-12 and higher education systems and creating more cohesive structures, programs, and initiatives at both levels, students will be better supported throughout this transition. As a result, college readiness, access, and success rates will improve and the benefits of a college education will be attainable for a larger and more representative population of American students.

One initiative that clearly straddles the high school and college divide and has been credited with improving college readiness, access and success is dual credit. Dual credit programs offer high school students the opportunity to earn high school credit for college courses taken at or through higher education institutions, generally through local partnership agreements enacted between participating secondary and post-secondary institutions. Similar to dual credit, concurrent enrollment opportunities allow high school students to take college courses while still enrolled in high school (without earning high school credits). This study examines dual credit and, to a lesser degree, concurrent enrollment, from a P-16 framework and uses a state-level lens to provide insight into dual credit programs and associated alignment issues, specifically those related to dual credit coursework patterns, student populations, and data.

With rapidly growing dual credit populations, a diversity of student and institutional participants, and a fairly high degree of institutional autonomy for programs that still fall within broad state-guidelines, Texas is an excellent place to study dual credit issues. In terms of policy and data issues, Texas dual credit programs sit at the four-way intersection of local and state, and K-12 and higher education authority. The state K-12 agency, the state higher education coordinating agency, local high schools and school districts, and state two-and four-year post-secondary educational institutions are all involved in dual credit coordination. This mixed methods study uses a multifaceted approach to investigate dual credit programs in Texas and to provide insight into program participation and the state-level data that are used to characterize it. Alignment issues, particularly those related to dual credit data and high school and college courses linkages, provide concrete examples of how P-16 alignment plays out in practice. Four specific research questions are addressed:

Research Question 1: Do current statewide reporting systems provide consistent, accurate, and useful data about student enrollment in dual credit and concurrent enrollment courses?

Research Question 2: Did the population and proportion of Texas public high school graduates who took academic dual credit courses, non-academic dual credit courses, or both change from 2004 to 2007?

Research Question 3: For the population of Texas public high school students who enroll in dual credit courses while in high school, does the average number of dual credit courses taken differ by type of courses taken (academic, non-academic or both), gender, economic status, race, region, type of high school attended, type of college enrollment, and persistence in the first year of college?

Research Question 4: For the population of Texas public high school students who enroll in dual credit courses, are there differences in average Grade Point Average (GPA) by type of dual credit courses taken, gender, economic status, race, region, type of high school attended, type of college enrollment, and persistence in the first year of college?

State-Level Perspectives on P-16 Education

Of the P-16 efforts that have been successfully initiated or expanded in the last decade, state-level activities and programs are arguably the most visible. The global and national challenges ahead are of great concern to state-level leaders, particularly those that might be met with improved educational outcomes (Achieve & N.G.A., 2005). Although federal involvement in preschool, K-12, and postsecondary education is growing, states still bear most of the responsibility for overseeing and improving public educational systems. Many analysts note that if progress is going to take place, it will happen at the state level (Olson, 2001). As a result, numerous states have embraced the P-16 approach as a way to conceptualize and organize their improvement efforts.

Academic Readiness

How to best realize effective educational change is a question that state-level policy-makers have tackled with intensity since the powerful *A Nation at Risk* report was published over 25 years ago (USDE, 2003). Although the report initially sparked a reform movement directed at the K-12 sector, increased concern about the need for improved college outcomes caused many policy makers to embrace a more comprehensive, P-16 approach to reform. Numerous studies (see, for example, Adelman, 1999; Adelman, 2006; Greene & Winters, 2005) point to lack of academic preparation in high school as an important factor in postsecondary attrition and stagnant degree completion rates. Remediation rates have increased while performance gaps between minority and low-income students and their more privileged peers remain a concern.

Sweeping statewide efforts to improve performance at the secondary level and close achievement gaps are expanding to include college readiness and postsecondary results. States are enhancing their accountability systems and improving their data collection capabilities to better gauge the scope and effectiveness of their efforts (see, for example, Conklin & Sanford, 2007). However, cross-sector alignment is a challenging undertaking. Accountability, data, and policy alignment decisions must be carefully shaped, taking into account the complex interrelationships among students, schools, and historically distinct education levels. Gaining a better understanding of the specific programs that cross the high school/college divide helps states determine if progress is occurring and how to concentrate future alignment efforts. In this study, dual credit serves as an avenue for exploring the potential and the complexities of P-16 alignment.

P-16 and College Readiness in Texas

The state of Texas is a national leader in implementing statewide policies that reflect a P-16 approach to educational reform. Although these policies cover many aspects of college readiness, access, and success, academic preparation for college is a primary focus of state legislators and policy-makers. Texas, like the nation, is grappling with a rapidly changing demographic profile. The population of Hispanic residents continues to grow, and high immigration rates coupled with job stratification have led to difficult financial circumstances for many individuals and families. The economic downturn that began in 2008 has added to overall economic uncertainties and increased focus on providing cost-effective educational alternatives.

In the 1990s, the state focused many of its educational reform efforts on improving academic quality in the K-12 sector. Increasingly more rigorous state accountability tests were developed, new state-wide curriculum guidelines were adopted, and more comprehensive and intensive course and graduation requirements were mandated. Overall, there was a heightening of educational expectations and standards for all students, with emphasis on closing achievement gaps and equalizing educational opportunities. Growing understanding of the importance of K-12 preparation for college and the role of secondary and post-secondary integration in improving college readiness, access, and success, led state-level education stakeholders beyond K-12 reform towards a more P-16-focused approach (Kirst &Venezia, 2004). But despite recent efforts at alignment, the college participation, performance, and graduation rates of economically disadvantaged, Hispanic, and African American students continue to lag behind those of their white, Asian, and economically non-disadvantaged peers. In addition, educational gaps between female and male students are increasing (Texas Higher Education Coordinating Board, 2009).

Texas has supported several curriculum-based initiatives to improve college access, readiness and success including developing college readiness standards, strengthening graduation requirements, and continuing to increase accountability measures for high schools and colleges. Some policies and programs are the result of legislative mandates while others have been developed by state agencies or through nationally recognized programs, such as the College Board's Advanced Placement (AP) courses and International Baccalaureate (IB) programs. In addition to state and national efforts, a number of college-readiness-related programs have been developed and are administered on the local or regional level, many with state oversight. Dual credit is one of the most extensive of these locally-administered initiatives.

Dual Credit Participation in Texas

Dual credit coursetaking has increased substantially over the past decade in Texas. The Texas Higher Education Coordinating Board (THECB), the appointed board and affiliated state agency with responsibilities for coordinating higher education activities in Texas, has kept records of dual credit participation since fall 1999. These records show an over 600 percent increase in dual credit participation over the past 10 years from 11,921 students in fall 1999 to 79,074 in fall 2008 (THECB, n.d). Dual credit programs are developed and coordinated locally in Texas, but state-level rules and guidelines from the THECB and the K-12 coordinating agency, the Texas Education Agency (TEA), apply.

Traditionally, TEA and THECB have worked relatively autonomously. Their missions, however, increasingly overlap. The THECB's *Closing the Gaps by 2015* plan includes goals for increasing participation and success levels at colleges and universities across the state. The plan acknowledges the impact of student high school preparation levels on subsequent college participation and success (THECB, 2000). Dual credit is one area where agency overlap is readily apparent.

Currently, dual credit programs provide tens of thousands of Texas public high school students the opportunity to take challenging college-level courses and improve their college readiness levels. Many believe these course opportunities offer students varied and rigorous coursework options for their final years of high school while exposing them to the expectations, culture, and rhythms of college (Bailey & Karp, 2003; Vargas, 2004; Hoffman, Vargas, & Santos, 2008). As noted, dual credit programs in Texas can be considered unique from a P-16 systems perspective because they bridge K-12 and higher education systems, as well as state and local government arenas, with each stakeholder group playing a significant role in the collaboration.

Traditionally, dual credit programs have been viewed as an opportunity for the most able students to move into college-level coursework. Increasingly, however, these programs target middle-ability students or those who are traditionally under-represented in higher education, many with promising results (Hoffman, 2003; Karp, Bailey, Hughes & Fermin, 2004, 2005; Karp, Calcagno, Hughes, Jeong, & Bailey 2007). These latter categories of students are critical populations to reach if *Closing the Gaps* goals are to be achieved in Texas. Because of the large and diverse populations that dual credit programs reach and the programs' unique place in the K-12 through postsecondary continuum, dual credit initiatives provide an excellent opportunity to make progress toward two important state-level goals: improving the high-school-to-college transition for a broad range of students, and exploring the challenges and potential of P-16 alignment across sectors.

Dual Credit Data Alignment

One common theme echoed by national P-16 experts and education analysts is the importance of developing data bases that span the P-16 spectrum to more effectively track student progress across educational levels (McLendon & Heller, 2002). L'Orange and Ewell (2007) believe states should "prevent[s] education sectors from acting independently and at cross purposes to one another" (p. 5). Collecting high quality, coordinated data is one way to do this. However, many experts believe state databases are deficient in providing the means to examine high-school-to-college transitions (Venezia, Finney & Callan, 2007; Lerner &Brand, 2007). In order to understand if local efforts like dual credit programs make a difference on a state-wide scale, mechanisms to link student-level data across state databases are essential. Unfortunately, when dual credit data are collected in different formats, and only limited data are available at the state level, program analysis is challenging. This study explores dual credit data in Texas with a focus on collecting and comparing data from different sources to increase understanding of how data alignment issues impact dual credit program alignment. The study's examination of dual credit student populations and coursework patterns relies on data informed by this analysis of data alignment and on additional sources that provide insight into the data and other aspects of dual credit programs.

Dual Credit Student Populations and Coursework Patterns

In their analysis of credit-based transition programs and related research, Bailey and Karp (2003) stress the need for more information and data about the size and characteristics of dual credit programs, and the students who populate them:

> Although it appears that the programs are spreading, we lack any clear sense of how many students are involved … Much of the recent growth in interest in credit-based transition programs results from a conviction that such programs can improve educational outcomes for a broad range of students. Nevertheless, we do not have definitive information on the distribution of characteristics of participating students. Our overall sense is that these programs are still most likely to attract traditionally college-bound students, and even those which seek a broader range of student participants have entry requirements that may screen out many of the students who need help. (p. 32-33)

While dual credit programs in Texas are coordinated through local agreements between high schools and colleges and records are kept at the local level, the THECB and TEA collect some state-level data about students who take dual credit and concurrent enrollment courses. These data can be linked through student identification numbers to a variety of student characteristics, although definitions of those characteristics occasionally vary across the databases. Another variation occurs in the type of dual credit coursework records collected. TEA gathers records of the courses a student completes in high school as part of its extensive K-12 data collection process; high school courses taken under dual credit arrangements are identified in the system. THECB, on the other hand, collects the dual credit contact hours that students attempt but collects no student-level information about the courses or disciplines in which the hours were attempted.

Academic and Non-academic Dual Credit Coursework

Texas eligibility requirements for dual credit participation differentiate between academic courses and technical and workforce education courses. In this study, dual credit courses are labeled "academic" and "non-academic," with a slightly different definition than the broad one provided in state guidelines. For this study, courses that are academic in nature (courses in English, social studies, science, mathematics, and foreign languages) are labeled "academic" dual credit courses. They are differentiated from dual credit technical, workforce, and enrichment courses which are labeled "non-academic."

Generally, the “non-academic” courses are the courses for which a lower eligibility threshold is applied.

Texas public colleges and universities have some leeway in how they interpret state dual credit eligibility rules for courses that do not readily fit into the three subject/skill areas which are included in eligibility tests: reading, writing, and math. Institutions can also impose higher eligibility standards on dual credit students than those set by state policy. State guidelines for dual credit courses are outlined in Dual Credit rule section of the Texas Administrative Code (TAC, Title 19, Chapter 4, § D) and linked to Texas Success Initiative (TSI) requirements (TAC, Title 19, Chapter 4, § C). TSI rules set readiness standards for all public college enrollees and prescribe developmental education interventions for those who are not deemed academically ready for college work. This link in the requirements ensures that dual credit students have met similar or the same readiness guidelines expected of traditional-aged college students before they are allowed to take academic dual credit courses.

This study closely explores differences among and between student populations based on enrollment in academic versus non-academic dual credit courses to determine where and how the populations may differ and overlap. Differences in eligibility requirements are a consideration in the investigation since they affect who is able to enroll.

Dual Credit Course Crosswalks and Data Misalignment

A course “crosswalk” is the connection or link between a college course in which a student enrolls and the high school course for which the student also receives credit.

Generally, linked college and high school courses do not have the same title and course description but do have related course content and objectives and are found in the same discipline area.

A preliminary review of TEA and THECB data and program information related to dual credit courses suggested the possibility of misalignment and inconsistencies in dual credit definitions, policies, and practices, particularly those that relate to dual credit crosswalks, data collection, and types of enrollment (dual versus concurrent). This study was designed to explore state-level data and program policies as well as local policy and practice to try to provide a clearer picture of dual credit programs in Texas. The specific focus is on dual credit coursework patterns (including types of coursetaking and course crosswalks), differences in student populations, data alignment, and, from a broader perspective, how P-16 alignment issues are played out in the data and in the field. The research inquiry and affiliated research questions were designed to first explore the nature of the data and of course alignment issues and then provide descriptive and statistical information about student populations and coursework patterns that is informed by the investigation of data alignment issues.

Methodology

For this study, a mixture of quantitative and qualitative research methods was employed to explore differences in dual credit and concurrent enrollment data, student populations, and coursework patterns in Texas. College freshman outcomes for identified participants were also analyzed, including type of enrollment in college (two-year Texas college, four-year Texas college or university, or unknown), persistence in the first year of college (whether the student was still enrolled in college one academic year after initial matriculation), and cumulative GPA at the end of the freshman year.

The first portion of the research process was an examination of state and local dual credit data, using triangulation techniques to understand the quality, accuracy, and consistency of the data. This analysis included a review of dual credit partnership agreements signed by Texas public colleges and partner high schools, an analysis of available dual credit high school to college "crosswalk" documents, and interviews with dual credit coordinators from high schools, colleges, and universities. It also explored dual credit participation records across the TEA and THECB databases using comparisons of student records to identify data inconsistencies. This multi-faceted approach helped clarify data alignment issues within the context of dual credit policy and practice at the state and local level, and in the secondary and postsecondary sectors.

Understanding the data from different contexts enhanced the study in that it: (1) allowed for more detailed representations of the limitations inherent in the data – limitations that were not fully understood previously; (2) informed the process of choosing the most appropriate data subsets for further analyses, and (3) provided additional background materials for the interpretation of the statistical results. The results of this portion of the study primarily addressed Research Question One: Do current statewide reporting systems provide consistent, accurate, and useful data about student enrollment in dual credit and concurrent enrollment courses?

The primary focus of the second portion of the study was an analysis of descriptive demographic and outcome data, with emphasis on students who take academic dual credit courses, non-academic dual credit courses, or both. The study examined students from a cohort of 2004 to 2007 Texas public high school graduates who took one or more dual credit courses while in high school. These students were grouped by gender, ethnicity, and economic status (determined by free or reduced lunch status), type of high school attended at time of graduation (including rural, and two categories of urban/suburban high schools), and the geographic region in which that high school was located (High Plains, Northwest, Metroplex, Northeast, Southeast, Gulf Coast, Central, South, West and Upper Rio Grande). College outcomes, including type of college enrollment, freshman GPA, and first year college persistence, were studied to better understand the transition to college for dual credit students. The descriptive data also included demographic information about the full population of 2004-2007 Texas public high school graduates for comparison purposes. This data was used to answer Research Question Two (see p.3).

The third facet of the research used two analysis of variance (ANOVA) models to illustrate differences in dual credit student populations, coursetaking frequencies, and coursework patterns. All of the categorical variables used for the descriptive portion of the analysis described above served as independent variables in these analyses except for freshman GPA. The first ANOVA used the total number of dual credit courses taken as the dependent variable to differentiate coursetaking levels for different subgroups. This ANOVA provided information for answering Research Question Three. Finally, college freshman GPA was explored in Research Question Four, for which GPA served as the dependent variable and the categorical variables remained the same.

Data from the TEA Public Education Information Management System (PEIMS) and THECB databases were the main sources of data used in the analysis. Adjustments were made to the cohort based on results from the exploration of data alignment to provide the most accurate representation of dual credit coursetaking possible within the constraints of the data and the study design.

As P-16 experts and dual credit researchers attest, a lack of information about dual credit participation and structures hinders understanding of the scope of dual credit programs and the potential impact of dual credit courses on college readiness, access, and success (Bailey & Karp, 2003). This study provides information about dual credit populations, coursetaking and data alignment that helps inform the discussion of differences in dual credit coursetaking and coursetaker populations and also enhances understanding of issues related to P-16 alignment.

Limitations of the Study

Data Limitations

As with any study that relies on data, this study was limited by the data available for analysis. However, what is unusual about this study is that a primary focus of the research is analysis of available data to determine the scope of the data limitations. Because TEA and THECB databases collect dual credit data in somewhat different ways, the data are not easily corroborated, making it difficult to know the accuracy of the information conveyed. High schools and colleges report dual credit data differently because of differences in database structures as well as collection policies and procedures. There are also significant variations in reporting both within each system (K-

12 and higher education) and across regions or service areas because of differences in dual credit agreements, policies, or interpretations of guidelines.

One goal of this study was to highlight differences in the data collected and then provide the best picture possible of dual credit participation given the available data. Because data limitations were such an important element of this study, the results provide detailed information about the limitations identified in the study's data collection process.

There are several pieces of dual credit enrollment-related data that are either not available in the two agency databases, or are collected at TEA but were not available to the researcher. For example, grades in college and high school courses are not reported in either system, although THECB does collect overall college GPAs. Therefore, performance in dual credit courses cannot be followed. THECB does not currently have access to student assessment data, which could prove helpful in determining student ability, but it does have SAT results. However, because these are self reported and not available for all students, they were not incorporated into the analysis.

It is important to note that this study sought to establish differences between populations that take different types of dual credit courses, not to establish causal relationships between dual credit coursetaking patterns, student populations, and college outcomes. Differences in the types of students who select to take various types of dual credit courses can be established, but the true benefits they derive from those courses cannot be known through available data. Selectivity, in terms of limitations on who is allowed to enroll in dual credit courses, and selection issues, related to the difficulties of knowing what might distinguish a student who selects a dual credit course from a student who meets eligibility requirements and does not choose to enroll, make it especially difficult to speculate about causal links.

THECB and TEA statewide databases do not include information about dual credit course delivery methods. Data on whether a course is offered on a college campus, a high school campus, or through distance learning is not available through these sources; however the 2007 THECB dual credit survey does provide this information for some institutions (THECB, 2007). Also, the scope of this research did not include dual credit funding issues, an important and complex aspect of dual credit programs. In many cases, dual credit courses are subsidized for high school students. The opportunity to dual credit courses for free or with reduced tuition is a strong inducement for students. Without additional research, it is difficult to determine how much of a role financial considerations might play in determining dual credit coursetaking behaviors.

Researcher Limitations

"The long journey we are embarking upon arises out of awareness on our part that, at every point in our research – in our observing, our interpreting, our reporting, and everything else we do as researchers – we inject a host of assumptions" (Crotty, 2003, p. 17). Although it may be easier to grasp how researchers "inject assumptions" into every aspect of their research when that work is primarily of a qualitative nature, it is important to recognize the role that a researcher's perspective plays in quantitative research design and analysis. Revealing errors, misinterpretations, and questionable assumptions about how data has been reported is an important aspect of this research project. Researcher assumptions and limitations can influence this and other aspects of the research, including decisions about database selection, study design and implementation, and data analysis. The data may tell a story, but the researcher is responsible for shaping how that story is told.

At the time the research was conducted, the researcher was serving as a Student Policy Fellow at the Texas Higher Education Coordinating Board. While the agency generously allowed the researcher access to data and resources, the research was conducted separately from work responsibilities and the opinions expressed and recommendations forwarded are those of the researcher alone. While the research activities clearly demonstrate that the researcher made consistent efforts to understand and accurately represent local perspectives, the researcher's background and professional experience are in state-level policy and program administration and are reflected in the state-level emphasis of this research.

Definition of Terms

General

P-16 Education is an approach that conceptualizes education as a continuum that spans from preschool through the baccalaureate degree (grade 16).

College Access is a comprehensive term used to describe ability to enroll in higher education. Access can be related to many student and institutional characteristics that influence enrollment including financial, geographic, academic, psychological and cultural factors.

College Readiness refers to having the personal and academic skills and qualities needed to be successful once enrolled in college. This includes readiness to enroll in college-level courses without remediation, the ability to earn passing grades in freshman-level courses, and persistence beyond the initial semester of enrollment. College readiness can also be measured through college success as defined as degree completion (see next definition).

College Success is used in different ways in this study. While always related to successful college outcomes, it will refer to the completion of a two- or four-year college degree, unless otherwise specified. Where noted, it will refer to outcomes related to college readiness that indicate a successful transition to college, such as enrollment, freshman GPA and persistence in the first year of college.

College-Level Courses for High School Students

Dual Credit Courses are college-level courses taken by high school students for both high school and college credit. Offered through local agreements between colleges and high schools, dual credit courses are generally delivered on the high school campus, college campus, or through distance learning. Course instructors may be high school or college faculty whose qualifications meet college accreditation standards. Dual credit enrollees may include high school students only or a mix of high school and college students.

Concurrent Enrollment is enrollment in a college-level course while still in high school. The enrollee earns college credit for the course, but does not earn high school credit.

Advanced Placement (AP) Courses allow students to take college-level courses while in high school. Sponsored through the College Board, a national membership organization that oversees course content and develops examinations, AP courses are high school courses taught by high school faculty. Many colleges and universities provide credit or placement for students who have scored at a pre-determined level on standardized AP examinations. Currently, thirty-seven AP courses and examinations are available to high school students in a number of subject areas (College Board, 2008).

Relationship between AP and Dual Credit*.* An AP course is not considered a dual credit course for the purposes of this study unless the course is also offered for local college credit (see dual credit overlay definition below). TEA guidelines specify that "AP courses are taken at the high school and do not count as dual credit, although the student will have college credit for the course once they enroll in a college, provided they [sic] pass the AP end of course test " (PEIMS, n.d.).

Dual Credit/AP Overlay Courses are joint offerings of AP and dual credit courses. The requirements for both types of courses must be met for these courses to be included in the statewide reporting system under both programs. College credit for dual credit/AP overlay courses is available in two ways: through a dual credit agreement with a local higher education institution based on the grade earned in the class, or through the AP program examination grade, if the credit is granted by the higher education institution in which the student subsequently enrolls.

Articulated Credit Programs are local partnership programs between school districts and community or technical colleges that allow high school students to take technical/workforce education courses that align with college offerings and receive credit when they enroll in the partner college after high school graduation. Often additional requirement apply for credit to be granted.

Dual Credit Coursework Patterns

Dual Credit Coursework Patterns is a broad term used specifically in this study to refer to descriptive aspects of the dual credit courses being studied. Coursework patterns may refer to the type of course (see academic and non-academic below), specific course linkages/crosswalks for high school and college courses, the location of the course (course delivery location) and the delivery method (traditional classroom, distance education, etc.).

Academic Courses can be defined in several ways. The THECB considers lower division courses found in the state's Academic Course Guide Manual (ACGM) academic courses. Generally, a student must demonstrate college-readiness in the areas of math, reading, and writing (see Texas Success Initiative on page 23) to qualify to take academic courses at a Texas public college. The definition of academic courses is sometimes used more loosely for dual credit courses, although students must also demonstrated proficiency in the math, reading, and writing to qualify to take academic dual credit courses. Since course titles taken for dual credit can only be identified in the TEA database, academic courses were defined for the purposes of this study as the list of TEA courses which were classified as academic by the researcher. These courses included all courses in the Texas Essential Knowledge and Skills (TEKS) curriculum in the areas of English, mathematics, science, social studies and foreign languages. Some select innovative and magnet courses that fit within these course disciplines were also included.

Non-Academic Dual Credit Courses is a term created for use in this study to define dual credit courses that were technical and workforce in nature, or were offered in "enrichment" areas such as physical education or the arts. These were courses for which colleges sometime but not always required that dual credit eligibility rules for academic courses be met. (Many were courses for which it can be argued that the mathematics, reading, and writing proficiencies do not directly apply).

Dual Credit Course "Crosswalks." Although the term crosswalk is frequently used to refer to data or materials that are matched from one sector/area to another, for the purposes of this study, the term refered to the specific high school and college courses that were linked for dual credit through a local course agreement. The student takes a college course, but a high school course must be identified for the student to receive high school credit. For example, the college courses English 1301 and 1302 (Composition I and II) might be linked to the high school course, English IV. Crosswalks are relatively easy to compare across levels if full course titles are available. Standard course titles are used in Texas public high schools, except in the case of locally developed courses, and colleges use lower-division course titles from (or that can be linked to) the Texas common course numbering system.

State-Level Programs and Reporting Systems/Elements Related to Dual Credit

Texas Essential Knowledge and Skills (TEKS) is the state curriculum for K-12 public school students.

Texas Assessment of Knowledge and Skills (TAKS) is the statewide assessment program designed to test student content and skill mastery of critical areas of the TEKS curriculum. According to THECB rules, students who receive a passing score of 2100 on the grade 10 TAKS mathematics and English Language Arts (ELA) tests are eligible to take technical or workforce education dual credit courses. Students who receive a 2200 on the grade 10 TAKS in math and ELA (with an ELA essay score of 3 or better) are eligible to take academic dual credit courses in a related area at a Texas public higher education institution. Students who achieve these scores on the grade 11 exit-level TAKS in mathematics and ELA have met the Texas Success Initiative (TSI) standard for readiness to take college-level courses and may sign up for academic dual credit courses in the senior year (if not already qualified with grade 10 test results).

Texas Success Initiative (TSI) is a THECB program designed to determine readiness for college-level courses and determine developmental education needs for students who are not deemed prepared for college-level work. In addition to qualifying to take dual credit courses through TAKS performance, THECB board rules allow high school students to qualify to take dual credit courses by meeting college readiness standards on TSI approved tests, including the Texas Higher Education Assessment (THEA), which was formerly known as the Texas Academic Skills Program (TASP) test, as well as the ASSET, Accuplacer, and COMPASS assessments, which are diagnostic college-readiness assessment developed by national test developers (TAC, Title 19, Chapter 4, D §4.85).

Public Education Management System (PEIMS) is the public school data repository for the state of Texas which is maintained by the Texas Education Agency.

Course Service Codes are the unique numbers used to identify approved K-12 courses in the PEIMS system. They are reported on a student-level coursework record (Record 415) for all Texas public school students and can be linked through student identifiers to demographic and other student-level reports.

Dual Credit Identifier Code is a PEIMS field which identifies a specific high school code in a student's record as a dual credit course. According to TEA guidelines, a student may "receive high school credit for a college course if there is an existing state high school course with TEKS that are met by the college course" (PEIMS, n.d.).

Persistence in the First Year of College is the measure that follows a student from the time of enrollment (the fall following high school graduation) to enrollment the following fall. This measure is sometimes called one-year persistence.

CBM Reporting System is the system through which the THECB collects extensive data from public colleges and universities, and more limited data from Texas private post-secondary institutions. The data specifications are outlined in the Coordinating Board Reporting and Procedures Manuals (CBMs). Public Universities; Community, Technical and State Colleges; Health-Related Institutions; Community Career Schools, and Colleges; and Independent Colleges and Universities are included. Numbered reports within each manual provide information on student-level data, course-level data, facilities usage, faculty data, etc. Credit hours attempted by a student through a dual credit agreement are reported in the CBM 001 reports.

Texas Public Education Information Resource (TPEIR) is a joint TEA and THECB effort which makes linked high-school to college data available through an interactive data website.

Fall 2007 THECB Dual Credit Survey is a survey of Texas public colleges and universities about their dual credit practices that was conducted by THECB staff. The survey requested dual credit crosswalks for college courses offered for dual credit in the 2006-2007 academic year (THECB,2007b).

Organization of the Study

This study is organized into six chapters. The first chapter introduces the topic, outlines research questions and methodologies, defines terms, and summarizes limitations. Chapter Two is a review of the relevant literature. The review addresses broad economic and demographic reasons for educational reform and P-16 approaches, and then discusses college readiness, access, and success from historical and research-based perspectives. The theoretical basis for the research is explored in depth in Chapter Two, including organizational theories that emphasize a systems perspective. The chapter concludes with a discussion of high school to college initiatives including the role of state-level involvement in P-16 collaborations, P-16 data alignment issues, academic readiness for college, the importance of the high school senior year, and credit-based transition programs with emphasis on dual credit initiatives.

Chapter Three is a discussion of the research methodology. It includes detailed information about the methods selected and the data files which were created for the study.

Chapter Four presents the results of the study related to Research Question One, including the comparison of dual credit data across TEA and THECB databases, the dual credit agreement review, the analysis of course crosswalks and related documents, and the results of interviews with high school and college dual credit coordinators from around the state. Chapter Five presents data relating to Research Questions Two, Three and Four and includes the construction of the dual credit cohort data file, results of the descriptive analysis of coursework patterns and other demographic data, and results of the two ANOVA statistical tests which were conducted. Finally, Chapter Six includes a discussion of the findings, policy recommendations, and ideas for future research.

Given its size and demographic diversity, along with the availability of longitudinal student-level data available across sectors, Texas is an excellent place to study P-16 initiatives like dual credit programs from a state-level perspective. Assuring that accurate, aligned data is available for understanding and evaluating those programs is of critical importance.

CHAPTER TWO: REVIEW OF THE LITERATURE

What is P-16?

State and national leaders and policy makers have relied on the nation's major educational systems as a means to both respond to and effect societal change. Although these systems share the same broad goal of providing education, they have very different organizational structures, cultures, philosophies, and missions (Callan, Finney, Kirst, Usdan, & Venezia, 2006). As a result of these differences, these systems often act in isolation. Growing challenges within, across, and outside the educational spectrum have, however, caused policy-makers to examine how the differing structures and characteristics of these systems may impede their ability to effect needed and sustainable change (Kirst & Usdan, 2007).

"P-16" is a relatively new approach for conceptualizing education aimed at helping educational institutions and the students who move through them better adapt to the challenges ahead. The perspective supports a view of educational policy and reform that spans preschool through the baccalaureate degree (grade 16) and emphasizes better integration and alignment among preschool, K-12, and higher education systems. The P-16 vision is often characterized as an educational "pipeline" or "continuum" that facilitates smooth student transitions from grade to grade and level to level. (Kazis, Pennington & Conklin, 2003; Van de Water & Rainwater, 2001).

The overarching P-16 theme of improving connections and outcomes within and across educational levels is a broad idea that can be easily linked to many school- and student-related issues from teacher training to student engagement to statewide finance.

The perspective can be framed in a theoretical context, but also has numerous practical applications. This flexibility of purpose within a clear and easy-to-understand concept may be a key reason why P-16 has been embraced by statewide policy-makers. A closer look at the concept and how it is applied provides insight into the effectiveness, appropriateness, and sustainability of this approach to education reform.

Scope of the Literature Review

This literature review broadly explores a dimension of the P-16 approach that has received significant attention over the last decade: the transition from high school to college as it relates to college readiness, access, and success. Why this transition has become more important to leaders at the state and national level is considered first. The next section discusses readiness and access issues from a historical perspective, including the emergence of the P-16 perspective. Theoretical perspectives are then discussed as P-16 and college readiness, access, and success are considered through the lens of systems and organizational theories. These theories provide insight into why system alignment is a challenge. The P-16 approach is further explored through other theories, mainly from the field of sociology, which provide a different lens for thinking about whether and how P-16 focused change could provide greater college readiness, access, and success for a larger and more diverse group of American students.

After building an historical and theoretical backdrop, the researcher looks at the more practical side of college readiness, access, and success by considering the nature of the concepts, presenting a statistical picture of where the problems lie, and discussing major policy concerns and initiatives related to the high-school-to-college transition. A primary focus is academic readiness for college and related state-level policy. However, economic, social, cultural, and political aspects of access are also included since readiness and access issues clearly interrelate. Curriculum rigor, developmental education, college-level high school courses, and the effective use of the high school senior year are the main aspects of academic readiness that are considered in this section.

By providing a broad overview of P-16 goals and approaches, then focusing more specifically on college access readiness and success, and, finally, emphasizing college-level high school courses as one of many avenues towards college readiness, the discussion sets the stage for the last section of the chapter: an overview of how dual credit courses play an integral role in the high school to college transition. Highlighting the broader context in which dual credit courses fit is important for understanding the significance of these programs and how they inform larger P-16 alignment issues. Understanding the role of state-level policy and data alignment within the dual credit framework is also important.

P-16 Alignment and College Readiness

Reacting to External Challenges

Economic Challenges

In reaction to rapid and significant economic, social, and demographic changes, business, community, and government leaders have turned to America's educational systems. The shift from an industrial to an information-driven economy has been marked by a proliferation of technologies that have radically changed the way Americans live and work. These new technologies, including rapid advances in communication capabilities, coupled with open trade and immigration policies, have contributed to the creation of a global economy (Friedman, 2005). America, long accustomed to economic dominance, faces economic challenges from emerging nations like India and China, which are not only producing products and services at ever-increasing rates, but are also providing human capital in the form of well-trained and educated citizens with expertise in fields deemed critical in the new world economy – including the so called STEM fields of science, technology, engineering and math (Augustine, 2005). One international measurement of math and science skills, the Trends in Mathematics and Science Study (TIMSS) (NCES, 2003), indicates that American student performance falls significantly behind a number of international peers (Mullis, Martin, Gonzalez, & Chrostowski, 2004; Martin, Mullis, Gonzalez, & Chrostowski, 2004). Results on the recent Program for International Student Assessment (PISA) show "15-year-old students in the U.S. continue to perform, in science and mathematics, at levels that demonstrate conclusively that far too many are unprepared for the global economy" (National Governors Association, n.d., ¶ 1).

The types of jobs needed to sustain the American economy are shifting with the creation of more high-skilled jobs requiring post-secondary education, but college graduation rates are stagnating and show significant and growing racial and socio-economic gaps (Haycock, 2006). Better literacy, numeracy, and reasoning skills are now required for most fields that pay a living wage, even those that have not traditionally required post-secondary training. "There is overwhelming evidence that, in the next generation, only those with post-secondary education will be able to get and keep a good job" (Lingenfelter, 2003, p. 1). Government and business leaders are concerned that the United States might lose its economic dominance as globalization creates a more interconnected and competitive international workforce; consequently, they put pressure on educational systems and policy makers to work together to improve the overall education level of the American population (Carnevale & Desrochers, 2002) .

Social, Civic, and Demographic Challenges

Helping citizens adapt to changes in the nation's demographic, social, and civic landscape might also be addressed through increased educational achievement. According to Van de Water and Rainwater, "the complexity of life in an increasingly diverse democracy puts a premium on citizens' ability to think critically about public issues and perform responsibly in public affairs at the community, state, and national levels" (2001, p. 4). Research shows that people with a college degree vote more, volunteer more often, and are healthier and more physically fit than those without one (Baum & Ma, 2007). From early proponents of public education like John Dewey, whose progressive-era philosophies tied education with civic responsibility (Dewey, 1916/2004), to current policy makers, one rationale for improving education has always been the public good.

Major demographic changes and the accompanying social and cultural shifts that come with them have also put pressure on our educational systems to adapt. Examples include changes in the ethnic make-up of the American population due to increased immigration, primarily from Latin America. From 1980 to 2000, the Latino population more than doubled (Hobbs & Stoops, 2002), and changes in family demographics included the rise of single-parent households, households which are statistically poorer than dual parent ones (Welniak & Posey, 2005). Community leaders often point to demographic differences when discussing gaps in school achievement. When outcome statistics for both K-12 and higher education are compared by economic background and ethnicity, low income, Latino, and African American students often perform at lower levels than their white, Asian, and more economically privileged peers (Greene & Winters, 2005; Haycock, 2006; Massey, Charles, Lundy, & Fischer, 2003).

Demographers warn that if education gaps are not closed for African Americans and Latinos who are graduating from high school and college at lower rates, our workforce will become less well educated at a time when more jobs require higher education. The exponential growth in the Latino population in many parts of the country makes it especially important to close these gaps. And because college-going rates are increasingly tied to earning power (Baum & Ma, 2007), it is not only socially, but politically and economically desirable – some would say essential – that we increase not only the size but also the diversity of our college populations to help prevent further stratification of American society.

Another interesting educational demographic phenomenon is the growing gender gap in education, with females outperforming males on many measures, and African American and Latino males faring worst on critical outcomes like high school and college graduation rates. Although this gender gap does not receive the attention that ethnic and economic gaps do in the literature that addresses readiness, access, and success, it has increasingly caught the attention of researchers and policy makers, (Conlin, 2003; "For Every 100 Girls," 2006; NCES, 2004) and it has certainly caught the attention of college admissions counselors (Britz, 2006). If men were to enroll and succeed in higher education at the levels currently being achieved by women, it would result in a significant increase in overall graduation rates.

The emphasis on providing effective post-secondary education for a much larger and more diverse population has, not surprisingly, increased scrutiny of educational structures, practices, and policies surrounding the transition from high school to college. The strong support for a P-16 approach to this transition comes from policy-makers and educational experts who are reacting to meet the demands of America's changing economic, demographic, and civic landscape. The bi-partisan nature of this support highlights the commitment that leaders and their constituents have to this goal (see, for example, Achieve and NGA, 2005).

A broad historical look at American education provides some examples of ways in which educational systems have proactively addressed or reactively responded to external changes and challenges.

Historical Background

The expectation that the majority of United States students can and should go to college is a relatively new idea. The mission of America's earliest colleges was significantly narrower than the multiple missions of today's higher education institutions. Before the Civil War, colleges were primarily private. They trained the sons of landowners and other elites to be members of the clergy and for professions such as the law and medicine. This training was generally achieved through a prescribed curriculum grounded in the classical tradition. Although meritorious students of lesser means were sometimes admitted, and admission was not competitive by today's standards, access was generally limited (Brubacher & Rudy, 2004).

Post Civil War

After the Civil War, there was considerable growth in higher education. This was primarily the result of the two Morrill Acts (1862 and 1890) which provided public lands to states for the purpose of establishing public post-secondary institutions. These so called Land Grant colleges were established at a time when the country's population was predominantly engaged in agriculture and spread across rural areas. The institutions emphasized agricultural and technical fields like engineering, as well as teaching. The Morrill Acts resulted in greater college access for rural students and increased economic diversity in the student body (Brubacher & Rudy, 2004).

The period of time after the Civil War also saw an increase in other kinds of diversity in higher education. The second Morrill Act (1890) was written so that states had to provide college education for African Americans, if not in the initial land grant, then through establishing "separate but equal" land grant colleges. This resulted in the establishment of a number of public colleges for African Americans. Several private colleges and universities for African Americans were also established during this period. Historically Black Colleges and Universities (HBCUs) played an important role in bringing diversity to higher education and producing leaders and ideas that helped change the national consciousness about race and equality (Williams, 2004).

Women also began gaining access to post-secondary education after the Civil War. Several elite all-women's colleges were founded in the latter half of the nineteenth century, including Vassar, Wellesley, Smith, and Bryn Mawr (Solomon, 1985). But the growth of coeducation in less elite public and private universities at this time accounted for most of the participation by women in higher education. In fact by 1890, 43 percent of colleges and universities in the United States were coeducational (Gordon, 1990). Toward the turn of the century and beyond, many female enrollees attended normal schools to be trained as teachers. The growth in the demand for teachers was very high during this period (Solomon, 1985) with secondary school enrollments growing from 202,000 in 1890 to 1,900,000 in 1910 (Lazerson, 2001).

Although a greater diversity of students attended college during the latter part of the nineteenth century, access, or the ability of students to enroll in college, was still fairly limited. In 1900, only 3 percent of the college-aged population was enrolled in higher education (Brubacher & Rudy, 2004). But with the rapid growth of high schools and an economy that was becoming increasingly industrial, college was no longer seen as just for the elite, but also as an option for the best students from public high schools.

Not surprisingly, as access increased at the end of the 19^{th} century, so did interest in high school-to-college transition. Around this time progressive ideals led to an interest in education and the role it could play in improving democracy (Dewey, 1916/2004). An interest in increasing the level of fairness in the high school to college articulation process followed. Until this time, institutions generally acted independently in setting enrollment criteria. Colleges tended to enroll students who had prepared at schools that college staff members were familiar with, often private college preparatory schools (Lemann, 1999).

Michigan was the first state to attempt to make the college admission process more consistent by developing a certification process. Students who took the required high school courses and were certified by the high school as having done so were automatically admitted to college. This method spread through the Midwest and did have an impact on high school curricula, but it remained a regional approach (Leonard, 1953). Perhaps the most important early development in the history of high-school-to-college articulation occurred in 1892 when the National Education Association (NEA) formed a committee headed by Charles Eliot, the president of Harvard, to look at high school curricula and college enrollment requirements to try to make the admission process more equitable and consistent. The “Committee of Ten,” looked at curriculum in a number of areas and made recommendations for greater uniformity of expectations. The group, which was predominantly made up of higher education representatives, took the approach that a college preparatory curriculum would be appropriate for high schools, even though most graduates did not go on to college (Brubacher & Rudy, 2004).

In 1900, less than a decade after the Committee of Ten was convened, the College Entrance Examination Board (CEEB) was formed to bring further consistency to the high school to college transition. The board developed essay tests in key curricular areas and, as intelligence testing became more popular after its use in World War I, developed a scholastic intelligence measure, the Scholastic Aptitude Test (SAT), which was viewed as a means to increase access for students with scholastic merit even if they came from unknown high schools or schools with inferior programs. There was "heightened concern among colleges about the market for students, that is, how to recruit students and be assured of their academic competence in a world where public high schools of unknown quality were graduating students in ever greater numbers" (Lazerson, 2001, p. 379). This perspective on the test as a meritocratic instrument changed, however, in the latter half of the century, when the SAT and similar standardized tests were criticized for limiting access and restricting equity for some student populations due to biases in the test (Lemann, 1999). Despite the growth in high school enrollments and more standardized pathways to college through testing and curriculum changes, NCES statistics indicate that at about the time World War II began, only about 6% of men and 4% of women completed a four year degree (Snyder, 1993).

Education after World War II

The second half of the twentieth century saw a large rise in educational attainment. By mid-century over half of the American population earned a high school diploma. The college enrollment rate of 18-19 year olds doubled between 1950 and 1991, expanding from 30 percent to 60 percent of the age group enrolled; for 20-24 year olds, the enrollment rate jumped from nine percent in 1950 to 30 percent in 1990 (Snyder, 1993). The growth of public community colleges was extensive during the beginning half of this period. In 1953, 210,000 students attended public two-year colleges. There were

740,000 two-year college enrollees in 1963, 2,890,000 in 1973 and 4,459,000 in 1983 (Snyder). The booming growth in the open access community college system ensured access for more and a greater diversity of students.

Several federal policies and the accompanying legislative acts that funded them led to an infusion of money and students into higher education after World War II. The first, passed in 1944, was the Servicemen's Readjustment Act (1944, P.L. 346) more commonly known as the GI Bill. This legislation brought thousands of returning GIs into the classroom, many who would not otherwise have attended college, and marked the beginning of a new era of access in higher education. As more students enrolled in college, greater attention was given to the kind of preparation that was best for aspiring students and how to best gauge their readiness. In an extensive review of articulation research from this period, Jones and Ortner (1954) found that both academic and social adjustment to college were deemed important by most researchers, although there was disagreement about how much weight to accord each.

The success of the veterans who returned after World War II, and the economic boom they fueled, was accompanied by increased funding for education. The Cold War and the national response to the Soviet Sputnik launch resulted in a significant federal investment in education through the National Defense Education Act (NDEA) of 1958 (P.L. 85-864). This law dedicated funds to science, math, and engineering programs and education at both the K-12 and postsecondary levels. The Higher Education Act (HEA) of 1965 (P.L. 89-329) authorized large amounts of money for direct student financial aid.

All of the federal and state support for higher education kept costs low and improved access for students with financial challenges.

The Civil Rights and women's movements also contributed to the growth in access at colleges. As women and minorities aspired to professional careers, they enrolled in higher numbers. Education was seen as a route for social as well as economic mobility, and at a time when the divorce rate was growing, it was a route for economic security for many women.

Because of their low tuition, varied curricula, and visible presence in the community, community colleges gave options to minority and lower income students and made post-secondary education more accessible for students who may not typically have considered attending college. Community college's open access philosophies changed the notion of what academic readiness for college entailed, since a high school diploma or GED is all that was required for admission to most. It has been argued that community colleges serve to limit access to four-year institutions and reduce the likelihood that a student will earn a four-year degree, and researchers have found that similar students are less likely to get a four-year degree if they start at a community college (Kane & Rouse, 1999). However, according to Rouse (1995), the increased educational attainment of community college students who would not have attended a four-year institution makes up for any negative effects of two-year enrollment.

Changes in the System and "A Nation at Risk"

For several decades after World War II, large numbers of students were enrolling in college, and public high schools were successfully preparing their "top" students for this transition. Despite significant growth in higher education, neither secondary schools nor society saw higher education as the appropriate avenue for all students. In fact, although the mission of public high schools had always been seen as much broader than that of college preparation, high schools were becoming more diversified in terms of curriculum and scope than they had been in the earlier parts of the century. The current educational psychology and changing social norms of the time suggested that children be given choices, and large comprehensive high schools did exactly that (Powell, Farrar, & Cohen, 1986). As populations became less rural, high schools grew in size, with large suburban and urban high schools that had the capacity to offer different paths and tracks for students. And as more whites left urban areas for suburbs, many in response to busing and growing crime rates in cities, urban schools suffered. Differentiations between schools grew, as criticisms of the overall system mounted.

In 1983 the landmark report *A Nation at Risk* (USDE) was published raising serious concerns about the quality of the nation's public education system. The report was critical of educational policies and noted performance gaps between student demographic groups. After it was published, many state-level reforms were implemented in response to the disparate or declining K-12 outcomes that were highlighted (Owens, 2004).

P-16 History

A Nation at Risk focused primarily on K-12 education. The first round of interventions that followed the report did not significantly involve higher education. "For the most part, however, higher education remained on the sidelines of these reform efforts" (Haslam & Rubenstein, 2000, p. 1). However, in the late 1980s and early 1990s, before the term P-16 was widely used, state department of education-sponsored collaborative efforts between K-12 and postsecondary institutions grew substantially in number (Hawthorne & Zusman, 1992). Many schools and colleges turned to collaborative approaches to address attrition, minority gaps, and developmental education issues. These collaborations stressed growing awareness of the interconnectedness of the two systems and the usefulness of cooperative efforts for improving student performance. Their success focused attention on the potential for larger collaborative efforts to improve cross-system transitions and overall outcomes (Hawthorne & Zusman, 1992).

The K-16 movement began and grew in the wake of K-12 reform efforts at the state level. In the 1990s, the term K-16 began to appear in state and educational policy documents. Government, education, and business leaders embraced the idea that a comprehensive, systematic approach to education might be effective for improving educational transitions (Van de Water & Rainwater, 2001). One of the earliest K-12 issues that was linked to higher education was teacher education. Teacher education and teacher education programs were a critical focus of The Holmes Group reports (1986; 1990; 1995) as well as state policy makers who recognized the important links among higher education, K-12, and the teachers and researchers that move across these sectors (Zimpher, 1999). The preschool sector was also included in the discussion and the term P-16 became more commonly used, perhaps in response to several research studies that came out in the 1990s showing the critical importance of the first years of life to brain development (Catherwood, 1999; MacNaughton, 2004), as well as in response to research showing the potential for preschool programs to close education gaps and improve educational outcomes (Karoly, Kilburn, & Cannon, 2005).

Although it has been shown that interest in the high school to college transition existed long before the term P-16 was developed, current research and policy analysis suggests that there is room for improvement in how we help students prepare for and access a college education. Looking at the transition from the more holistic and structural P-16 perspective adds breadth and dimension to the discussion. There is an extensive body of research on education that highlights the complexity of the issues facing our educational systems. Systems and related organizational theories, many borrowed from business models, provide a useful way of conceptualizing how educational structures and systems might help or hinder students and institutions as they navigate the transition from high school to college. Theories from the field of psychology and sociology also help illuminate issues pertinent to higher education readiness, access, and success. The next section discusses these theoretical approaches.

P-16 and Systems Theories

Systems theories are often applied to large educational organizations because educational organizations are complex and varied in terms of mission, governance, financing and scope. Looking at the three large education systems (Preschool, K-12, and higher education) from a systems theory perspective helps illuminate differences in how the systems are structured and provides models for how they might be better aligned.

Although P-16 rhetoric may appear to support the creation of one P-16 system rather than the three separate systems that currently exist, a careful look at P-16 literature shows that the emphasis is on improving transitions and alignment across the systems (see, for example, Conley, 2005; Hoffman et al., 2007).

Systems theories explain organizations as systems of interconnected layers and levels. These theories often conceptualize organizations as living or organic systems (Morgan, 1998). In fact, the early roots of general systems theory can be traced to the field of biology in the 1950s (Owens, 2004). Thinking of an organization as a living system puts emphasis on the interdependence of the organization's parts and identifies the human and environmental components of the organization as being as critical to its overall functioning as the technical and mechanical aspects. While mechanical models of organizations, such as those described by Max Weber, focus on the production aspects of organizations (Morgan, 1998), they may be best suited for characterizing organizations with simple missions or processes. Systems models provide a better way to conceptualize complex organizations.

Theorists identify different types of systems. Open systems are sensitive to outside environmental influences, whereas closed systems function with less regard to the external environment. Linkages between subsystems can be seen as loosely or tightly coupled just as the structure within the systems can have differing levels of flexibility and rigidity (Birnbaum, 1988). Organizational systems can also be viewed in a linear way, with inputs at one end and outputs at another, or they can be viewed as more circular and fluid. Linear versus circular approaches may depend on the major emphasis of a systems theory. Systems theories can also focus on the structural, political, or social/cultural aspects of an organization. Because general systems theory is based on an interdependence model, most systems theories recognize the importance of all of these components, but emphasize one over the others in their approach. For example, a system's model of P-16 alignment might primarily be viewed as a structural concept with political and social/cultural dimensions.

From the perspective of policy-makers who would like to increase the number of students who enroll and succeed in college, thinking about education from an open systems perspective makes sense. Open systems theory emphasizes how the environment interacts with and influences the system and how the system interacts with and influences the environment (reactive and proactive). According to Morgan (1998), "Organizations and their environments are engaged in a pattern of co-creation, where each one produces the other" (p. 56). The need for better educational system alignment has been espoused by external stake-holders (government, business, civic leaders, etc.) in response to the economic and social changes described earlier. When the American education system was not supporting the perceived needs of the environment, the environment put pressure on the system to change (Hawthorne & Zusman, 1992). If external groups had been satisfied with the system's outputs (the ability of students to meet civic and employment needs, for example) the system would, most likely, have been undisturbed.

Out of some of the early K-16 collaborations came the recognition that strong organizational differences between high schools and colleges sometimes made joint projects difficult (Hawthorne & Zussman, 1992). Barriers to collaboration included "lack of institutional rewards and incentives for participation . . . and . . .differences in [the] cultures, perceptions, and priorities of the two sectors" (p. 435). In a later study of barriers to cross-state alignment concerns are raised about the limited opportunities for educators to discuss alignment (McLendon & Heller, 2002). Increasing communication between the sectors is frequently cited in P-16 literature as a crucial part of the integration process. Tafel and Eberhart (1999) promote alignment as a means to share responsibilities across sectors. K-12 and higher education partners need to "share common goals, perceive that the collaboration advances their own interests (and, if significant resources are required, that of their institutions), and make a genuine commitment to the project in terms of leadership, personnel time, and other resources" (Hawthorne & Zusman, 1992, p. 434). Better alignment of the educational systems might help institutions achieve these attributes of successful collaborations.

It is not surprising that organizational challenges have emerged in K-12 and postsecondary sectors. In the United States, K-12 educational systems evolved and function very differently from higher education systems. Higher education is generally seen as having three major missions: teaching and learning, research, and service. The major mission of the K-12 system is teaching and learning. From a systems perspective, higher education institutions might be thought of as loosely coupled with many subunits that vary in their level of connection to each other and the whole. Governance in postsecondary institutions tends to be diffuse, with dual or shared governance systems (Birnbaum, 1988). These systems provide a balanced power structure between the faculty and administration that is not built into the K-12 sector structure.

Because K-12 systems are more bureaucratic and less autonomous, they might be seen as tightly coupled or bounded systems. Large colleges and universities, on the other hand, are sometimes characterized as organized anarchies, with diffuse goals and fluid participation in activities (Birnbaum, 1988). This is a much looser model of governance than seen in K-12. Change is a process that occurs as ideas move through the system, promoted by internal stakeholders who use their influence and power to advocate for reform. Politics play a role in both systems, but power structures can be less clear in higher education leaving more room for political action that crosses institutional layers.

Just as they are governed differently, public high schools and public colleges also tend to be financed differently. While tax revenues from state and local government provide almost all K-12 funding, state government funding of higher education has decreased considerably over the last three decades as a share of institutional revenues (Hovey, 1999). With proportionately less state funding, postsecondary institutions are responsible for providing a higher percentage of their operating expenses. This has led to tuition increases and more reliance on money raised through fundraising, grants, and research. It might be argued that these shifts in higher education financing increase an institution's autonomy and reduce state government control. There are several examples of state governments that have allowed higher education institutions more autonomy in response to reduced state funding. A good example of this is tuition deregulation in Texas; in 2003, the state legislature passed a bill that allows public higher education institutions to set their own tuition levels.

Differences in financing structure can influence high school and college collaborations. Much of the current pressure to improve alignment is being generated at the state government level. K-12 and higher education collaborations are often seen as related to higher education's service and teaching missions. If emphasis on generating research revenues continues to grow in higher education, particularly privately funded research, then universities might find it expedient to reduce their emphasis on teaching and service (Washburn, 2005). This, in turn, could reduce the likelihood of higher education institutions making a strong commitment to K-12 alignment, even with governmental pressure to do so. With a tenure and promotion structure and rewards that are tied to research output, the service mission is already a low priority for many faculty members who may choose to avoid collaborative efforts unless incentives are offered.

Community colleges have made strong strides in high school to college linkages through dual credit courses, early college high school programs, bridge programs, etc. Perhaps this is because they are more reliant on public funds and their mission is tied to service and instruction. This makes sense if it is true that "organizational decision making is more analytic when groups have common goals, but more political otherwise" (March & Simon, 1958, as cited in Bolman & Deal, 2003, p. 37). If the higher education sector perceives shared goals with K-12, it may remove some of the politics from the process of alignment. According to Morgan (1998), organizational leaders must be able to "scan and sense changes in task and contextual environments, bridge and manage critical boundaries and areas of interdependence, and develop appropriate operational and strategic responses" (p. 42). To do this, the systems need to be open to interdependence. For one to change, the other must change (Haslam & Rubenstein, 2000).

It is difficult to align two separate systems without a means to collaborate. Even at the state level, the agencies that coordinate K-12 and higher education have traditionally been separate (although Florida recently and boldly merged their agencies into one). Organizations like state P-16 councils are a way that many states have adopted to try to integrate systems and help coordinate reform efforts. Hawthorne and Zusman (1992) observed that issues of local control made a difference in how much state departments of education get involved in high school/college collaborations. Since their study, national changes in education policy, including the No Child Left Behind Act of 2001 (2002, P.L. 107-110), and strong state government focus on cross sector educational reform has led to a more top-down approach to collaboration with many initiatives coordinated at the state rather than the local level.

In addition to these abovementioned differences between K-12 and post-secondary education, there are other differences that may affect attempts to integrate or align them. For example, higher education is voluntary for students whereas K-12 is compulsory. K-12 students are usually minors so parents play a stronger role in the institutional culture than in higher education (although the new helicopter parent phenomenon in higher education may be changing that). Instructional schedules tend to differ between high school and college. And the educational requirements and certification systems for K-12 faculty differ from the more strenuous academic criteria and tenure system used to evaluate college faculty. These differences can lead to status issues which can negatively affect collaborations.

Despite the differences across systems, many strategies and programs for improving high school to college linkages have developed or expanded over the past decade. The challenges to creating a truly aligned system lie in overcoming system differences and finding ways to integrate student experiences and organizational approaches. Making connections, creating patterns of interaction, and understanding governance procedures across the systems may provide support for a more unified course of action. Hanson recognized how structuration can play a role in bringing systems together:

> Formal and informal expectations, regulations, information flows, norms, myths, values, laws and so forth tend to develop into *structuration* which is a form of *connectedness*. That is, the interaction between organizations becomes patterned through such means as information sharing, contractual relationships, formal and informal agreements, and mutual awareness of governance procedures. (2003, p. 282)

Toward a Theory of Alignment

Many of the researchers who believe academic readiness is the key component of the high school to college transition consider alignment between the systems an essential component to improving college readiness and success rates (Achieve 2006, 2007; Conley, 2005; Kirst &Venezia, 2004). The concept that better alignment between sectors will lead to improved student outcomes has been identified as an emerging “theory of alignment” (Daun-Barnett, 2005). The idea of developing better cross-sector alignment to improve outcomes fits into structural systems theory models, such as the one described in the previous paragraph. Social and political systems theories, which focus on how the interaction of people and groups can influence change, may also play a role since the process of alignment must be negotiated among the people, groups, and organizational systems and subsystems involved. While affecting sweeping change in K-12 education might be a matter of legislating top-down reforms, the differences between sectors and the more-diffuse governance and financing structure in higher education probably necessitates a more nuanced approach to implementing alignment initiatives if they are to be accepted and effective.

Certainly much of the alignment activity to date has been focused on K-12 change. Several recent large-scale national and state initiatives have addressed the structural aspects of alignment. Many have been focused on curriculum alignment across sectors such as the work of Standards for Success (Conley, 2003) and Achieve's American Diploma Project (Achieve, 2004). The standards project has focused on a collaborative approach to creating college-readiness curricular standards for high school that help students make the academic transition to higher education. Both college and high school faculty are involved. The American Diploma Project has focused on both curriculum and state exit level testing and how curriculum and accountability measures align to college expectations. ACT, Inc. (n.d.) has also published college readiness standards and a national curriculum survey that ties college readiness to curriculum and college testing. Several state governments have moved to reform curriculum standards, graduation requirements, and exit-level testing to align better with college expectations. More detail on these efforts will be provided later.

Sociological, Economic, and Related Theories

Other theories provide different frameworks for considering P-16 approaches. Functionalist theories fit well with the objectives of policy-makers and leaders who believe the American educational system must adapt to a changing society. These theories have early roots in the works of sociologist Emile Durkheim who wrote, “For a people to feel at any given moment the need to change its educational system, it is necessary that new ideas and needs have emerged for which the old system is no longer adequate” (Durkheim, 1977/1969, p. 92).

Structural functionalism and technical functionalism were strongly supported by educational sociologists in the mid-twentieth century, a time when the scientific method and sociological approaches were being applied to education (Karabel & Halsey, 1977). Proponents of the technical function theory believed that as technology increases and job skills rise, education adjusts to meet the employment needs of society, and more people are trained for higher level jobs. Certainly the idea that education can be manipulated to shape a workforce was in the thoughts of legislators who authorized large infusions of money into scientific and technical education at the time of the National Defense Education Act (1958, P.L. 85-864). Given our educational history, many leaders clearly still believe change of this sort is possible. Current experts predict that a high number of the jobs created in the Twenty-First Century will require post-secondary education (Carnevale & Desrochers, 2002). With a high number of underprepared students entering higher education, it makes sense from a functionalist perspective to target all levels of education if the desired economic result of a population with more degree holders is to be achieved.

Another theory with economic roots that highlights how education links to the economy is human capital theory. This theory came into popular usage in the 1950s and 1960s (see, for example, Becker, 1993; Mincer, 1958). Human capital theory links the production of goods and services to the people who provide them and recognizes differentiation in the labor force. Interestingly, Durkheim was an early observer of the importance of differentiation and linked the concept to functionalist ideas (Smith, 1973). Human capital theory "brings social institutions (such as schooling and the family) previously relegated to the purely cultural and superstructural spheres, into the realm of economic analysis" (Bowles & Gintis, 1975, p. 74). What workers bring to jobs in terms of skills, abilities, and motivation affects the level of human capital available to employers. If more human capital is needed to keep America's workforce competitive, then more education can help to do that. Like functionalism, it (human capital theory) stresses "the technical function of education and emphasize[s] the efficient use of human resources" (Karabel & Halsey, 1977, p. 13). Although human capital theory recognizes differences in the labor force and the role of education in augmenting employee skills, it has been critiqued for focusing on people as a mode of production and also for not recognizing the inherent class structure in society and in education which limits student mobility through the systems (Bowles & Gintis, 1972; 1975; Collins, 1971). These same critiques might also be made of functionalism.

Two theories with roots in the field of sociology also build on the idea of differences among individuals in terms of what they are able to bring to and gain from their lives and jobs. Yet these theories provide a different perspective on the role that schooling plays in society. The idea of cultural capital is introduced in the writings of Bourdieu (1977/1973) who saw the educational system as serving to reproduce the existing power and social structures in society. He believed that, while providing the perception of mobility to all, schools really serve to develop the cultural capital of students from the dominant culture, thereby supporting the existing class structure. The culture positions society as a meritocracy in which schools play a critical role in perpetuating the idea of a democratic system in which all students have equal opportunity to excel on their own merits. However, studies show that students are likely to attain the occupational status of their parents (Blau & Duncan,1967; Sewell, Haller & Portes, 1969). By providing a few students the opportunity to achieve beyond their original social status and gain cultural capital along the way, cultural capital serves to preserve the stability of the existing social structure, which is stratified (Bourdieu, 1977/1973). Max Weber's conflict theory, the idea that status groups compete and "impose their cultural standards on the selection process" (Collins, 1971, p. 1002) for jobs and to keep others out, also supports the idea that statification is unavoidable and unequal access to education will remain the norm.

The idea of social reproduction, which has its roots in Marxist thought, goes against the functionalist perspective. If one believes in social reproduction, it would be incongruous to believe that education can be easily shaped to fit changing societal needs.

Or would it? Either way, there is value in the argument that education can provide exposure to cultural capital for those who might not otherwise have been exposed. Studies of occupational attainment find that education is a primary pathway for advancement to a higher social strata (Collins, 1971) and studies of education's effects show that although "cognitive ability and socioeconomic status (original and destination) are often substantial … even together [they] do not account for all apparent 'education effects' " (Kingston, Hubbard, Lapp, Schroeder, & Wilson, 2003, p. 53). Changes in the number and diversity of students moving successfully through higher education over the last 100 years support the notion that access to the system has evolved with the social and economic changes of the times. As we have moved from an agrarian to an industrial to an information economy, our educational systems have adapted. Education has proactively and reactively responded to some societal changes. However, a lack of equity still remains.

The idea of social capital theory runs parallel to human capital theory. Social capital can contribute to the creation of human capital through society's major institutions (Coleman, 1988). Schools, families, and communities that support the social development and connectedness of students within these institutions provide them with the means to attain more human capital. Social capital emphasizes relationships with both individuals and communities; students with stronger ties (more social capital) may be more likely to stay engaged in school and be successful beyond it. While cultural capital theory is focused on maintaining the dominant culture, social capital might be better viewed as a means of connecting all students within and/or across cultures. Students from the non-dominant culture can benefit from social capital within their own culture and that can translate to success across boundaries, even the boundary from high school to college.

What do systems and alignment theories and human, cultural, and social capital theories provide to discussions of P-16 education and the transition from high school to college? If cultural capital theory suggests that education only serves to reproduce the dominant culture, then schools restrict the aspirations and access of under-represented students because they cannot be shaped to provide more than limited mobility through better alignment. There is some evidence to support this. For example, statistics show that low-income and minority student graduation rates from flagship universities are diminishing (Gerald & Haycock, 2006). Some populations continue to be seriously under-represented across higher education (Terenzini, Cabrera, & Bernal, 2001).

In contrast, functionalists might argue that the dominant American society has now recognized a need for increased participation in higher education; therefore, efforts to increase alignment and provide more access will be successful. Education can, in fact, be a means for mobility (Kingston et al., 2003) and increasing awareness of educational gaps might lead to strategies to lessen them. Perhaps this simply reflects a shift in the dominant culture due to demographic changes, but it also may reflect a fundamental shift in perspective about the detriments of limiting educational access. One example of this shift is the movement away from rigid tracking at the secondary school level, a practice that some experts believe seriously limits opportunity for minority and low-income students and perpetuates social stratification (Oakes, 1985).

An argument can be made for linking social and human capital theories to a P-16 approach to education. Schools can help students build social and human capital; this might be especially true for disadvantaged students who may have had less opportunity to build this capital at home. If schools can reach students while they are young, and provide them an aligned experience across the educational spectrum, more may develop the skills necessary for educational and employment success. The process of building social capital may also give students a stronger attachment to their school experience, such that they will be less likely to drop out or underperform. Of course, students of the dominant culture may be more likely to feel that attachement, thus perpetuating existing inequalities. At the college level, Tinto (1987) saw how connectedness to an institution resulted in stronger persistence and graduation rates, but Guiffrida (2006) and Tierney (1999) suggest that his theory is less robust when applied to students of color and other disadvantaged populations.

An advantage of coming from a social class in which one's parents have attained a post-secondary education is exposure to what it takes to prepare for, transition to, and succeed in college. Providing help to students with non-college parents is a clear focus of many P-16 efforts. Mentor programs, dual credit opportunities, college centers and college counselors based in high schools, college tour trips and summer college exposure programs help to better prepare students for the transition. So do programs aimed at middle school students that explain high school curricular choices and encourage early college aspirations (Wimberly & Noeth, 2005). P-16 proponents believe that even preschool and elementary students can benefit from information and encouragement about college.

A theory that primarily focuses on the development of what might be termed "intellectual capital" provides evidence for the social and civic advantages of increasing college enrollment and graduation rates. As society gets more complex, the ability to process information in more complex ways will help both individual citizens and society as a whole. Perry presents a scheme for intellectual and ethical development in college that he conceived after observing changes in how college students process information, formulate ideas and opinions, and develop perspectives on the world as they progress through their college classes. He observed that students moved from reacting to concepts and issues in a dualistic or "good versus bad / black versus white" manner to a more relativistic response that showed a much higher level of independent thought (Evans, Forney, & Guido-Dibrito, 1998). This observed growth may be one reason why people who have college degrees report different levels of civic participation than those who do not. However, Perry's theories also raise questions about when students are developmentally ready to begin college work, an important question as early college high schools and some dual credit programs attempt to move students through the first years of college while they are still of high school age.

Although P-16 proponents often present education as a pipeline, research indicates that there are many complex factors that contribute to student progress. Bowen and Bok (1998) prefer the image of a river to capture the movement of students through the educational system and into adulthood. "It is more helpful to think of the nurturing of talent as a process akin to moving down a winding river, with rock-strewn rapids and slow channels, muddy at times and clear at others. Particularly when race is involved, there is nothing simple, smooth, or highly predictable about the education of young people" (p. xxi). Some theories that examine race and students' school experiences do suggest an especially rocky path for students of color. For example, stereotype threat theory (Steele, 1997) proposes that students will live up to racially tainted expectations because of unconscious fear, and oppositional theory (Ogbu, 2004) suggests students will not excel in school simply to show their opposition to white school culture. Although many question the validity of this claim, it is still believed by others to have merit, though perhaps for more than one student population (Ainsworth-Darnell & Downey, 1998).

Beyond highlighting the difficulties for students of color, the winding river metaphor also highlights the complexity of student paths through the education system. The concept of an educational pathway is one that can be applied to both the student experience and the organizational aspects of a P-16 approach to college readiness, access, and success. Much of the literature about high school to college transitions, especially the P-16 focused literature, characterizes the routes students take to college as pathways (see, for example, Adelman, 2006; Bragg, Kim, & Rubin, 2005; Pathways to College Network, 2004). Statistical path analysis theory has been used to identify how student characteristics and choices lead to different educational and occupational outcomes (Sewell, Haller, & Portes, 1969). Adelman (2006) notes that pathways both to and through college are becoming more complex. Swirling, the concept of moving back and forth between two-and four- year institutions, is becoming more common. In addition, college-level high school coursetaking, online courses, for profit institutions, and multi-college centers are all increasing the diversity in what used to be a fairly traditional route to and through college. Some of these alternate pathways can make college more financially viable for students. But, whether they are labeled dead end paths or leaks in the pipeline, there is no denying that there are blocks along education pathways that can interfere with student progress. Eliminating those blocks, and creating, expanding, or improving student pathways are important P-16 goals.

An organizational concept from the field of economics, path dependency theory (Arthur, 1994), ties into the pathway concept and can be related to organizational approaches to P-16. This theory suggests that pathways can become so well established that it can be difficult and expensive to change them. Certainly the costs of better aligning secondary and postsecondary education are high if major institutional changes are needed, but in the long run there will be significant cost savings if P-16 alignment is implemented, savings related to increased efficiency and to better outcomes for students (Augenblick & Pettersen, 2001).

The next section will discuss more practical and empirical aspects of the P-16 perspective and high school to college readiness approaches that are being proposed and implemented to improve student pathways to college.

College Readiness, Access, and Success

Elements of and Inter-Relationships among Readiness, Access, and Success

Just as there are many pathways to college, there are many factors to consider when examining student transition from high school to college. In studies of community college access, Eaton (1994) identifies four broad categories of access: geographic, academic, financial, and personal; and Bragg et al. (2005) identify five dimensions: academic, personal, financial, cultural, and political. The Lumina Foundation (2007) includes preparation, awareness, financial issues, and institutional responsibilities in its schema for characterizing access and success issues. These many elements can be considered from a student-focused or an institution/organization focused-perspective; the inter-relationships between them are often complex.

As can be seen in all three categorizations above, college readiness is sometimes presented as a subset of college access that involves academic preparation. As academic readiness issues have gained momentum and the P-16 perspective has stressed the importance of academic alignment, related literature has begun to define college readiness as separate from access. Lumina more narrowly defines preparation as the role of the secondary institution, while stating "More than any other entity, higher education institutions directly influence access and success" (2007, ¶ 9). However, others see a more P-16 approach to responsibility for readiness, access, and success that focuses attention on alignment across the sectors. For example, in their identification of issues that affect readiness and access, Camblin, Gullatt, and Klopott (2003) classify P-16 curriculum alignment as a primary concern along with student trait indicators for college aspiration, attendance, and persistence; school reform efforts for at-risk students; and college intervention and outreach programs. For the purposes of this study, college readiness links a student's preparation for college with the student's experience once enrolled. Was the student "ready" for the academic work and the college culture, and able to self-motivate and self-direct in a new and possibly less-structured learning environment? Perhaps the most stressed aspect of readiness is academic readiness. A simple but useful way to define academic readiness is a student's likelihood to be successful in college-level coursework.

Academic Readiness

When academic readiness is removed from the definition of college access, access and success are less tightly linked. There seems to be a national shift from concern with access to concern with the readiness to success continuum. A report sponsored by the Association of American Colleges and Universities (2002) notes that access is currently being achieved and the focus must now turn to quality. Persistence, graduation rates, and performance, especially in highly-demanding majors like STEM fields, have become more of a measure of readiness than simple enrollment. Significant increases in college access over the last few decades have not corresponded to similar improvements in success measures such as graduation rates.

"In the absence of sound academic preparation, other dimensions of college readiness are probably moot" (Massey et al., 2003, p. 155). Unfortunately, many students are unsuitably led to see access as readiness. High schools do not want to discourage students so they do not prepare them for the rigor of college academics, rigor that exists even at community colleges which often have higher academic standards than students expect (Venezia, Kirst, & Antonio, 2003).

According to the National Center for Educational Statistics (NCES, 2006), the percentage of high school graduates who enrolled in higher education was over 72 percent in 2003-2004. This is a good indicator of how much access to higher education has increased over the years; enrollment growth has been especially strong at community colleges and proprietary institutions, with distance and online education programs removing some of the limitations of geographic access. Not surprisingly, the 80% of students who go to minimally selective or open access institutions are the ones found to have the biggest preparation problems (Kirst & Venezia, 2004). For many of these institutions, the hurdle to enroll is only high school graduation or a GED, and large numbers of students are not aware that they have academic deficits until they arrive on campus (Kirst &Venezia 2004). A high school degree does not always mean college readiness. McCarthy and Kuh (2006) note the mismatch between aspirations and readiness in recent High School Survey of Student Engagement results that show that four-fifths of the students surveyed plan to enroll in college (HSSSE, 2005), but a significant number do not display the academic habits that will be expected of them in college.

National developmental education statistics certainly highlight the lack of student preparation and alignment between systems: Estimates that vary anywhere from 29 percent to 50 percent of students who enter higher education require remedial education

(NCES, 2006; Roueche & Roueche, 1999; Van De Water and Rainwater, 2001). Data indicate that a student who is required to enroll in developmental education has significantly decreased chances of eventually earning a college degree (Pascarella & Terenzini). And although studies have shown that developmental education can increase the likelihood of under-prepared students graduating (Bettinger & Long, 2005), the longer a student remains in developmental education, the lower his or her likelihood for college success. In addition, the costs of developmental education are over one billion dollars a year (Bettinger & Long). But not providing remediation may also cost to the economy and society (Saxon & Boylan, 2001). Improving the quality of high school education and aligning high school to college curricula so that high school courses do prepare students for college-level work can help reduce the costs of developmental education to states, institutions, students, and society. This is a very strong argument for high school to college alignment.

Readiness and Access Gaps

As noted in the historical background section, although access to higher education has increased considerably, access gaps continue to exist between African American, Hispanic, and low-income students and higher income white and Asian American students (Greene & Winters, 2005; Massey et al., 2003). Minority and economically disadvantaged students remain underrepresented in four-year institutions and overrepresented in remedial education classes. By as early as 1988, ninety percent of eighth graders aspired to gain some postsecondary education and two-thirds planned to complete college (Hafner, Ingels, Schneider, Stevenson & Owings, 1990). Unfortunately, minority students were and are more likely to drop out at various points in the system between high school entrance and college graduation (Losen, Orfield & Balfanz, 2006). Many educators and policy makers point to differences in academic preparation as a major contributor to these gaps. “This group [those who do not finish] is disproportionately made up of low-income and minority students” (Carey, 2004. p.1).

In 2003, the Manhattan Institute released a study titled *Public High School Graduation and College Readiness Rates* which found that only 32 percent of high school students in the class of 2001 were academically qualified to attend four-year colleges (Greene & Winters, 2003). In a 2005 follow-up report, the authors found that only nine percent of college-ready graduates were African American and nine percent were Latino. The report further observes that the portion of all college freshmen includes a similar percentage of African American (11 percent) and Latinos (7 percent) suggesting that these student groups are under-represented due to readiness issues and not financial or other affirmative action issues and policies. Only about one-half of African American and Latino ninth graders graduate from high school within four years compared to 79 percent of Asian Americans and 72 percent of Whites” (Pathways, 2004). The average Latino 12th grader reads four grades levels below the average white 12th grader (Greene & Winters, 2003). Swail, Cabrera, and Lee (2004) found that students who were classified as academically “qualified” for higher education continued on to higher education at about the same rates regardless of ethnicity; unfortunately, many fewer Latino students fell into the “qualified” category than did whites. The persistent gaps in minority and low-income achievement do not begin in high school, but show up much earlier. Closing these gaps is an excellent reason to use P-16, or even cradle-to-career frameworks to accelerate achievement for students from a range of ages and backgrounds.

Other Aspects of Access

Of course, it is not always clear how much the academic aspects of college readiness and access interact and overlap with the other areas that influence whether students make a successful transition to college. A salient example of this might be a student who is academically ready for college but is hesitant or unable to enroll due to high tuition rates and insufficient financial aid. Money for student financial aid is limited, while college costs have risen much faster than the rate of inflation (St. John et al., 2004). Perception of college costs, often by low-income and minority students who do not understand financial aid and subsidies, also restrict access (Venezia, Kirst, & Antonio, 2003).

Student financial aid can have an impact on student decisions regarding college access, choice, and persistence (St. John et al., 2004). Preparing more high school students for college will only improve access if those students can afford to pay; funding P-16 initiatives without supporting student aid does not seem to make economic sense. However, some researchers disagree. When studying the intersection of academic preparation and financial/economic considerations, Stampen and Hansen (1999*)* found that lack of adequate preparation and not funding keeps poor students out of college.

Economic and cultural differences can also increase barriers to access for many students, especially those from low-socioeconomic backgrounds and African American, and Latino students. Gandara (2001) found that access involves many elements. Effective programs are culturally sensitive and offer financial, mentor and peer support, as well as academic support.

Finally, psychological aspects of access are important to consider. Although most studies focus on student motivation and personal attributes, Nakkula and Foster (2007) believe that academic readiness influences psychological aspects of access. They studied academic identity development at two early college high schools and found that students' "possible" selves were different than their "expected" selves. For these students, knowing that they could succeed was very different from just believing they could succeed. Building the confidence that comes with academic readiness is an important possibility offered by early college high schools and dual credit programs that provide a true college experience. For certain underrepresented populations, the difference in college aspirations (high) and actual college success (low) may be lessened if academic identities are strengthened through college experiences in high school.

P-16 Policy and Practice at the State Level

When state policy makers look at education from a P-16 perspective they usually look to across-level as well as within-level initiatives for improving student outcomes. To date, a number of significant ideas, initiatives, and actions have been organized under the P-16 framework. When the Elementary and Secondary Education Act was reauthorized in 1994, it included a mandate that states develop content and performance standards for K-12 Public schools. Requiring educational leaders to think about building knowledge progressively probably helped focus attention on vertical alignment from grade to grade, as well as on the system breaks that inhibit alignment. The No Child Left Behind Act of 2001 (2002) brought even greater federal presence into K-12 policy and took the emphasis beyond content and performance standards to accountability and assessment. Accountability and assessment are seen by many state policy-makers as integral to a P-16 approach because they allow for tracking progress within and across sectors and show achievement gaps across populations.

Although the effort to create a more seamless K-12 system bodes well for supporting a P-16 mind-set among secondary educators, content and performance standards and the assessments they are linked to must include enough rigor to ensure that students have the level of knowledge and skills required for college success. This may be difficult for a number of reasons. Traditionally, K-12 curricula have not been focused on preparing all students for college. The expectation has been that not everyone can or should go to college, and the way courses are structured and tracked in many schools support that expectation. Also, there is considerable variation in what colleges expect students to know and be able to do. How to accommodate higher educational expectations about standards becomes difficult if expectations vary widely across higher education institutions.

Much of the emphasis on P-16 educational change has had a top-down focus, with states taking the lead with the encouragement of national and business leaders. Because of state government links to both public K-12 and higher education funding, state-level efforts to support P-16 initiatives are likely to have the most impact. This is probably the reason that national and business leaders have put emphasis on state-level change. One way that these leaders have focused attention on these issues is through inter-state meetings.

A number of governor's conferences have addressed educational reform from a P-16 perspective and emphasized the importance of preparing more students for college and work. "Efficiency, fairness, and the economy" are pointed to as reasons for improving performance in and across state education systems (Kazis, Pennington & Conklin, 2003). Reducing educational costs, closing achievement gaps, and improving economic competitiveness are also goals that continue to be linked to P-16 efforts, as was seen earlier in this chapter.

Some of the P-16 related initiatives highlighted in the governors' meeting reports include creating integrated state-wide K-16 data systems (see also L'Orange & Ewell, 2007), aligning secondary assessments with postsecondary expectations (Achieve, 2004, 2006, 2007) and providing more school options for older adolescents such as dual credit and early college high schools. The Governors Summit Action Agenda for Improving America's High Schools (Achieve & NGA 2005) calls on state leaders to: make sure all students are proficient and prepared for college, create end-of-course assessments that link to college readiness; redesign the American high school; strengthen teachers; hold high schools and colleges accountable for student success; improve retention and graduation rates at two- and four-year colleges; streamline education governance; and create a single state board of education for all levels.

The progress made to date on some of the high school to college initiatives also shows that states are heeding the call to improve alignment and academic college readiness. As of 2007, twelve states had aligned their high school standards to college and career-ready standards, with seven in the previous two years, and twenty-seven states were working to do so. Five states reported eventual plans to align standards, and only six had no plans (Achieve, 2007). Initiatives to link exit-level examinations to college expectations are another means that states use to measure academic progress, although progress has been slower on this front; currently many states have exit exams and a few tie them to graduation (Achieve, 2007).

High School Exit Examinations and College Readiness

Although more research is needed on the link between exit exams and college readiness (Center on Education Policy, 2006), there are differing perspectives on how exit-level examinations affect student motivation and performance. A 1989 study (Catterall) reports that failing all or part of an exam adds to student doubts about graduation, even when those examinations cover only basic skills. Another study found that there is stronger community support for the exams if financial support is provided for assistance to those who need it (Gayler, 2004, p. 8). Costs of student remediation and teacher professional development are, in fact, hidden but significant in requiring exit examinations. However, resultant student progress may reduce later developmental education and other costs. An annual Center for Education Policy Report on state exit exams lists potential benefits and possible negative effects of administering these assessments. “More evidence has accumulated during the past year to suggest that exit exams are having positive effects on curriculum and instruction by encouraging school districts to cover more of the content included in state standards, better align curriculum and instruction with standards, and add remedial and other special courses for students at risk of failing the exams, all of which may be necessary precursors to increased student achievement (Gayler, 2004, pp. 9-10). Possible negative effects reported include dampening motivation and the possibility that exit tests linked to graduation will encourage some students to seek GEDs rather than pursue a high school diploma. “More comprehensive, long-term, state-level research may enable analysts to reach stronger conclusions in coming years about which exit exam policies lead to higher achievement and fewer drawbacks” (Gayler, 2004, p. 10).

In addition to state exit-level examinations, states have become more interested in aligning high school and college readiness assessments. In addition to using standard college admissions tests like the ACT and SAT, as well as a range of nationally available basic academic skills tests like COMPASS and Accuplacer, many colleges create their own assessments to gauge the knowledge and skills of entering freshmen. These tests rarely align with each other and students sometimes have difficulty understanding which tests to take and how they are used (Kirst & Venezia, 2004). States have taken different approaches to addressing the problem. For example, some states require all students to take an SAT or ACT test. Others, like Oregon, have created a system in which their high school exit level tests are aligned to state higher education expectations (Conley, 2003).

Other important areas in which states have or might become involved to improve high school to college alignment include aligning remedial courses, creating joint enrollment opportunities, aligning college admission and placement requirements with the high school calendar, increasing cross system feedback from higher education and high schools about how students are performing, and making more productive use of the senior year. Statewide efforts to increase graduation requirements are also a common P-16 intervention.

Curriculum

As Kati Haycock, a national proponent of P-16 reform noted, "When you look at the content and rigor of what's expected to graduate from high school, and you compare that with what you have to do, not just to gain entry to college but to enroll in credit-bearing coursework, the gap just knocks you in the face" (Olson, 2001, p. 1). College faculty members have high expectations regarding student preparation levels and even students who meet admission requirements may not have the skills and habits of mind to perform successfully in college-level work (Conley, 2003). One way to address the gap in preparation is to look more closely at academic coursework, curriculum, and graduation requirements.

In 1991, Cool and Keith found that "the path from coursework to achievement was the second strongest" after intellectual ability (p. 34). In *Answers in the Toolbox,* Clifford Adelman (1999) found that the quality and intensity of the high school curriculum are the most important predictors of completing a bachelor's degree.

Adelman found positive correlations between the highest level of math completed and bachelor's degree completion and revealed. He also reported that "the impact of a high school curriculum of high academic intensity and quality on degree completion is far more pronounced—and positively—for African-American and Latino students than any other pre-college indicator of academic resources" (p. 3). In addition, his research found a positive correlation between taking Advanced Placement (AP) courses and college readiness and success. And in their study *Influencing achievement through high school graduation requirements*, Chaney, Burgdorf, and Atash (1997) found that even students with marginal motivation and skills benefited by taking demanding courses. Students who failed a difficult course and then persisted and took the course again performed as well on a related achievement measure as students who passed the course on the first attempt.

States have looked to research on the affects of course rigor on performance to support increased curricular requirements for high school graduation and expanded college-level course offerings in high school. The notion that some students take a college preparatory track and some a vocational track is becoming dated. But does increasing requirements have the potential for increasing drop-out rates among students who do not aspire to college? More research is needed on the subject as states move towards stricter curricular requirements.

Achieve's American Diploma Project; The Stanford University Bridge program (sponsored by Stanford, the PEW Charitable trusts and the US Department of Education); and the Standards for Success Program (Sponsored by the American Association of

Universities and the PEW charitable trusts) are three of the major collaborative efforts in the last several years to explore how standards-based education and the alignment of high school curriculum and college expectations can better prepare students for higher education and reduce the need for remedial education. One strong message in these studies is that a high school degree should indicate readiness for college. The projects have been working to define a baseline of college readiness, although some caution that with the great variability in higher education, this is be difficult to do. There is great variation in college curricula, both in terms of what is taught and how it is taught. This variation can mean differing ideas of readiness. The American Diploma Project recently worked to define workplace and postsecondary benchmarks. Several states have also developed or are developing college readiness standards as part of their K-12 curriculum (Achieve, 2007). The Texas legislature approved Texas' college readiness standards in January of 2008 (THECB, January2008).

The High School Senior Year

Examining the structure of the senior year of high school reveals something about the disconnect between the end of high school and start of college. High school graduation exit level testing occurs in grades 10 and 11 in most states, and college entrance examinations are completed and applications submitted early in the senior year, if not sooner. Kirst (2000; 2005) argues that one of the problems with the senior year is that it is claimed by neither sector – high school or college – and it is easy to understand why. Students who have met graduation requirements may give up on rigorous courses in disciplines in which they have struggled in the past, and students who are already accepted to college may feel they have earned a break.

High schools and colleges may not be sending students a true message about what students need to accomplish in the senior year in order to be ready for and make the most of college. Many seniors slow down or find other outlets for their energies, including outside work which pulls many students away from their studies during this critical year (HSSSE, 2005) and is correlated with lower grades (Marsh & Kleitman, 2005). These decisions can come back to haunt students who aspire to a college degree. Coasting has dangers for all students, not only those who are under-performing. Although students learn at different paces, slowing the pace in the senior year can be detrimental to both high and low achieving students.

For students who are less prepared, taking advantage of the senior year to strengthen deficiencies may give them the skills they need to place out of or move quickly through college developmental education requirements. Students who are more prepared can take advantage of this time to take college-level high school courses. Students at both ends of the spectrum, and of course all of those in-between, may be more likely to graduate from college, and to graduate in a more timely manner, as a result of intensifying high school senior year efforts. The resulting cost savings to both individual students and the state are certainly a strong argument for making good use of high school opportunities.

College-Level High School Courses

As noted, college-level high school courses are one way for students to take real advantage of the senior year. These courses are an opportunity to meet remaining high school requirements while gaining college credit, or to move into college-level coursework because high school requirements have already been met. Recent increases in students taking Advanced Placement (AP), International Baccalaureate (IB), and dual credit courses indicate the students are taking advantage the senior year's potential for providing a "leg-up" on college. Bragg, Kim and Ruben (2005) surveyed 50 states and found the most common transition programs included AP, Tech Prep, Virtual schools and distance learning with over 90 percent of states providing policy support for these pathways. Bridge programs, CLEP, GED, Early College high schools, and IB had less than 50 percent policy support but were still very popular. As Catherine Boswell notes, greater academic challenges, like dual enrollment programs, can help students overcome senioritis (2001).

Dual Credit Programs

Dual credit programs have grown tremendously over the past decade. According to Karp and Bailey's extensive national study (2003) the greatest growth in credit based transition programs over the last several years has been in the area of dual credit and concurrent enrollment. As recently as winter 2008, at a time when many federal higher education programs were cut to allow Pell grant increases, President Bush approved several million dollars through the Fund for the Improvement of Postsecondary

Education (FIPSE) for the express purpose of increasing college access for high school students through dual enrollment programs (Field, 2008).

Dual credit growth in Texas reflects the national trends. O'Brien and Nelson (2004) found that enrollments quadrupled in Texas between 1990 and 2002. Since then the growth has accelerated (THECB, n.d.). A 2003 agreement between the Commissioner of Higher Education and Commissioner of Education allowing high schools and colleges to receive funding for students enrolled in dual credit programs is generally credited for helping to fuel that growth. Recent legislation (TEC, Chapter 28 §28.009) requiring all high schools to provide students the opportunity to take at least twelve hours of college-level coursework before graduation is also expected to increase enrollments.

As dual credit programs have grown, concerns about the programs have increased, but so has the body of literature that finds significant value and potential in these efforts. Dougan (2005) expresses concerns that students without a full high school experience have not had enough "time spent in learning, understanding, and reflection; and targeted, disciplined, and mature application" (pg. B20). She warns that dual credit programs could be "a fast track to academic disaster," (p. B20). However, other educators believe the programs are an appropriate and effective way to expose a range of students, including traditionally underrepresented students, to the college experience (see, for example, Andrews, 2000; Hoffman 2003, Hoffman, Vargas & Santos, 2008; Karp, Bailey, Hughes, Fermin, 2004; Prescott, 2006).

Quality and Access

While recognizing the potential in dual credit opportunities, many dual credit experts believe there are tensions inherent in the programs that must be balanced when developing, implementing, and evaluating them. In a state-level study of Illinois programs, Kim, Barnett, and Bragg (2003) found a tension between program accessibility and the importance of maintaining program quality and integrity. This is one of the most, if not the most, critical issues facing dual credit programs in this era of tremendous growth. As Krueger (2006) contends, "creating a mechanism for moving students through the system without paying attention to rigor or quality is a waste of student time and state resources" (p. 3). And, as Andrews stresses, high quality faculty and programs are critical for community college dual credit programs. Students will not enroll if the quality is suspect and the institution's reputation will be at risk (2000).

Reaching Non-Traditional Populations

Maintaining the academic integrity of dual credit courses is important; however, one of the much-touted reasons for expanding these programs is their potential to reach lower-ability and underrepresented students, and improve college access and success rates among these populations. Although "using credit-based transition programs for less-prepared students may seem counterintuitive" (Karp & Bailey, 2003, p. 3), policy makers see several benefits. For underrepresented students, dual credit programs can prepare students for the rigors of college, so that the adjustment is less stressful when they do transition. Students in college-level courses are exposed to realistic information about the skills needed for college success and have access to college faculty who can convey what that success might entail. Through dual credit courses, especially those held on a college campus, the college experience can be "demystified" for students who have had little exposure to the college environment (Karp et al., 2004). Karp (2006), however, found that dual credit courses must be "authentic" and "replicate the academic demands placed on college students" if students are to truly gain understanding of the college experience (p. 287).

For students who are disaffected with the curricular and other restrictions of high school, dual credit offers greater independence through expanded curricular options and schedule flexibility. Both high expectations and the opportunity to work more independently in an adult atmosphere can improve student motivation. And finally, because tuition is reduced or waived for many dual credit programs, participation can significantly lower the cost of college and the time-to-degree, important considerations for underrepresented students, many of whom have limited financial resources for college.

Research suggests that college outcomes can be improved for all dual credit students but those outcomes are even stronger for populations that traditionally have been lower performing. Unfortunately, these students who potentially could benefit most from exposure to college-level courses are participating least (Hoffman et al. 2008). One of the most extensive dual credit studies to date focused on Florida and New York City dual credit students. The researchers found that college outcomes are improved with dual credit programs, and claimed the gains were especially strong for low-income and male students (Karp et al., 2007). "Once limited to high-achieving students, [dual credit] programs are increasingly seen as a means to support the postsecondary preparation of average-achieving students" (p. 1). And, as Hoffman (2003) notes, with upper income students seven times more likely to earn a bachelor's degree by age 24 than lower income students, it is important for community college programs to allow students of varying backgrounds and abilities access to dual credit programs.

Flexibility and Consistency

In addition to highlighting the tension between access and quality, Kim et al. (2003) stress a growing tension between allowing flexibility in dual credit programs while maintaining consistency across programs. This tension can clearly be linked to the quality-versus-access issue if consistency is defined as a means to increase program quality and flexibility is viewed as a mechanism to encourage access through varied programming aimed at diverse populations. However, the two are not mutually exclusive. High quality programs can also be programs that allow access to a wide-range of students. These programs may, however, require more monitoring to ensure that rigor is maintained. One way to facilitate program monitoring and to help ensure consistency and quality is through better program and data alignment.

Dual Credit Data

Unfortunately, many experts believe state databases are deficient in providing the means to examine high school to college transitions (Venezia, Finney & Callan, 2007; Lerner &Brand, 2007, L'Orange, 2004). If local efforts like dual credit programs are to make a difference on a state-wide scale, mechanisms to link student-level data across state databases are essential. In their State Policymakers' guide to dual enrollment Hoffman, Vargos, and Santos note that few states have the ability to collect data on dual enrollment and link it with students' college performance (2008, p.8).

Texas Dual Credit Data and Outcome Studies

While Texas is one of the few states that does collect dual credit data at the state level, those data are collected in different formats by the state's two education agencies. Enrollment in dual credit courses can be linked to college outcomes (see, for example, THECB, June, 2008; Hargrove, Godin, & Dodd, 2008), but information on performance in dual credit coursework is not available at the state level nor is student-level course data for traditional college enrollees.

Keng and Dodd (2008) studied the performance of AP students and other groups at the University of Texas at Austin where more detailed performance data was available. In their study, performance in sequent courses (a course at the next level taken in a subject area) was tracked for students who took AP and were awarded credit based on exam results, students who took AP and did not earn credit based on exam results, students who took concurrent enrollment courses (including dual credit courses), and students who took neither. Not surprisingly, for many of the 10 subject areas studied, the performance of concurrent enrollment students in sequent courses fell between the performance of the students in the AP with exam and the students in the AP without exam groups. Comparisons of performance for all AP course and test takers compared to performance of concurrent enrollment students may have provided more insight into how these two programs compare.

Dual Credit Course Delivery

The ways in which dual credit courses are delivered vary not only in terms of where the courses are physically offered, but also in how the courses are structured and the faculty who teach them. Three of the major delivery systems for dual credit courses include courses located on college campuses, courses located on high school campuses, and courses offered through distance learning programs (Waits, Setzer, & Lewis, 2005). Dual credit courses are also increasingly offered through early college high schools, some of which are located on college campuses and some in more traditional high school settings. Dual credit courses are sometimes populated by high school students alone, and sometimes include a mixture of high school and college students. Dual credit literature suggests that there may be advantages and disadvantages to each type of delivery system, with differences in how different models affect student learners. For example, some students may thrive on the independence allowed on a college campus and others might need the structure of the high school classroom.

In a Texas-based study of dual credit students that looked at the method of course delivery as well as teacher qualifications, Swanson (2004) found little difference in the performance of students in sequent English classes after the students completed dual credit English courses in a high school classroom (all high school students) versus a college classroom (mixed high school and college students). She did detect a significant difference in performance in sequent social studies courses based on the type of dual credit classroom mix. Swanson's study was limited to a small population of students in a single community college system, involved a disproportionately white population (89%), and was conducted at a time when dual credit populations included mainly high-achieving students. As dual credit populations become more diverse, it will be important to examine how course delivery location affects program quality and outcomes in different ways for different types of students.

Technical and Workforce Dual Credit Programs

Dual credit programs in the career and technical education (CTE) area often target lower-performing students or those traditionally underrepresented in college. These programs are growing, and, importantly, many are increasingly focusing on academic skills, allowing students opportunity to develop the skills and confidence to continue into more academic college programs. In fact, research indicates the programs that pair academic and technical skills are better at preparing students for college success than traditional CTE programs (Dare, 2006).

In most states, dual credit courses are offered in both academic and technical areas, the latter often through tech prep or workforce education programs. Waits, Setzer, and Lewis (2005) found that, nationally, it is more likely for technical dual credit courses to be offered as part of a sequence, while academic courses are more likely to be offered "cafeteria style" for students who meet enrollment qualifications. Technical dual credit courses are popular options in Texas. Although Karp et al. (2007) found benefits to both academic and technical dual credit program participation, no known state-wide research has been done in Texas on the differences between students enrolling in the two types of programs and their subsequent college outcomes.

Another Model for College-Level Course Organization

Karp, Bailey, Hughes, and Fermin (2004) reflect the variety in dual credit options using a different model. They use three descriptions to organize dual credit courses and other accelerated credit programs. “Singleton” courses and programs are like cafeteria style courses; they focus on the content of a course with little coordination of the student experience outside of individual classes. AP programs fit into this category. “Comprehensive” programs offer more structure to high school students, and involve a cohesive plan for the student to follow. Tech prep programs are a good example of comprehensive programs. “Enhanced Comprehensive” programs are programs like early college high schools in which students are provided a significant amount of structure, mentoring, and support while they are participating in college-level high school courses. Understanding which of these types or varieties of programs is best for different populations will be important in future dual credit research.

Dual Credit Programs and P-16 Alignment

The idea that dual credit programs can be an avenue to better secondary and postsecondary alignment is prevalent in the literature. As early as 2000, Azinger stressed that high school/community college partnerships are an “important point of connection” (p.17) between the educational systems. Although he cited evidence showing that collaborations are a higher priority for community colleges than for high schools, experts more recently have highlighted the importance of sharing the responsibility for dual credit students between the high school and college sectors (Krueger, 2006).

State-Level P-16 Alignment

According to Farrell and Seifert (2007), 47 states have legislated state-level dual credit programs and/or policies. These researchers note conflict in the dual credit literature both among dual credit partners and in relation to state dual credit policies. Their research suggests that collaboration can be enhanced when partners work together to understand and implement state policies. Krueger (2006) believes "Dual enrollment can be a mechanism for aligning high school and postsecondary education, not merely a strategy for advancing students out of high school" (p.3). He thinks states can set standards for eligibility and at the same time structure programs in ways that will meet the needs of both high- and low-achievers. Making sure state-level curriculum and testing programs support the readiness goal of providing dual credit to a range of students is a good place to start. And, according to Hoffman, Vargas, and Santos (2008), ensuring that dual credit programs are "owned" somewhere in the state system is also important. Alignment across systems can be difficult if there are competing interests and no clear hierarchy of responsibilities.

Clearly dual credit programs blur the lines between high school and college in a number of different ways. These programs have much to teach us about how P-16 alignment has been and can be operationalized, and how to provide guidelines for best proceeding with future alignment efforts

Conclusion

Education is cumulative. “Expecting large annual gains in reading comprehension among juniors and seniors is like expecting large annual gains in swimming performance among juniors and seniors who have been training since childhood” (Jencks, 1985, p. 133).

The transition from high school to college is a critical time for students and a critical juncture at which K-12 and postsecondary education systems intersect. But if this transition is to be effective for a greater number of students, and lead not just to college access but to college success, it must be viewed as part of a larger educational experience – one that spans from preschool through college and provides students the cumulative academic preparation and social support necessary for that success. Ensuring that the organizations involved work in conjunction will help to facilitate improved student learning, but to do so organizational differences and biases must be minimized, communication and alignment must take priority, and outside environmental changes must be heeded. The world is changing and America’s education systems must change along with it.

CHAPTER THREE: METHODOLOGY

General Overview

This study explored dual credit data alignment, student populations, and coursetaking patterns in Texas. While quantitative data provided the foundation of the study, several qualitative approaches were used to determine the accuracy of the data available, compare reporting practices, data alignment, and program information across sources, and gain perspectives on regional and institutional differences in dual credit coursetaking. This approach was a form of triangulation, a research technique that "involves checking information that has been collected from different sources or methods for consistency of evidence across sources of data" (Mertens, 2005, p. 255). The quantitative aspects of the data analysis relied on descriptive statistics and two Analysis of Variance (ANOVA) models while the qualitative components included a review of dual credit agreements, a dual credit crosswalks analysis, and interviews with high school and college dual credit coordinators and other experts.

Dual credit agreements are developed and implemented on the local level, between school districts and colleges. Although approximately 96 percent of dual credit enrollment hours offered in Texas are offered through two-year public institutions, several public universities also offer dual credit opportunities (THECB, n.d.). While, state oversight of dual credit programs is limited, dual credit guidelines are provided through Texas Administrative Code rules for higher education institutions (TAC, Title 19, Chapter 4, §D) and data about student participation is collected by both the Texas

Higher Education Coordinating Board (THECB) and the Texas Education Agency (TEA).

This study assessed dual credit data and program alignment in Texas through comparisons across state data bases and other sources. The construction of a cohort of dual credit participants relied on information learned from the multi-source review. The cohort data is organized, disaggregated, and analyzed to provide demographic and longitudinal data about the proportion of 2004 to 2007 public high school graduates who enrolled in dual credit courses. Inferential statistical analyses were conducted on dual credit participation by the number of dual credit courses students attempted and freshman-year grade point averages (GPAs). The research provides information that deepens current understanding about the nature of dual credit data, the student populations served, and dual credit coursetaking patterns in Texas.

Restatement of Key Issues

The changing demographic, social, and economic environment in the United States has led leaders and educational policy makers to call for improved college readiness, access, and success for a larger and more diverse population of students. Many argue that a highly educated populace is an essential component of a smooth-running democracy and a competitive, adaptable workforce. To meet the educational challenges ahead, some state-level policy makers endorse a P-16 approach to education that promotes better cooperation across all sectors of education, especially the secondary and postsecondary sectors.

Dual credit programs, by definition, span the high school to college continuum. Research suggests that as dual credit participation grows, more information about dual credit programs and student populations is needed (Bailey & Karp, 2003; Krueger, 2006). In Texas, rapid growth in dual credit enrollments has occurred over the last several years (THECB, n.d.). Efforts to give high school students more and better access to college-level course material include a recent legislative initiative that requires public high schools to offer at least 12 credit hours of college-level credits to high school students (Texas Education Code, Chapter 28, §28.008). This and other efforts have increased pressures to expand dual credit opportunities in the state. However, the growth of dual credit programs has been accompanied by questions about program quality (Texas P-16 Council, 2007). The lack of consistent state-level data about dual credit programs contributes to the uncertainty and varied program structures (for example, early college-high schools and more traditional programs) make it difficult to monitor growth. Providing a clearer data picture of dual credit populations and coursetaking in Texas will aid policy makers and educators in shaping dual credit policy and practice into the next decade. Understanding the limitations of that data picture must also be part of the discussion.

Research Questions and Methodology Overview

The four primary research questions addressed by this study are listed below. Table 3.1 on page 89 provides a brief description of the method/s that were used to address each question:

Research Question 1: Do current statewide reporting systems provide consistent, accurate, and useful data about student enrollment in dual credit and concurrent enrollment courses.

Table 3.1 **Brief Summary of Research Methods**

#	Research Question	Method or Methods
1	Do current statewide reporting systems providing consistent, accurate, and useful data about student enrollment in dual credit and concurrent enrollment courses?	Merged data between TEA PEIMS and THECB CBM databases to compare dual credit records; Analyzed dual credit agreements; Create crosswalk analysis for high school and college course linkages using available data from THECB Dual Credit Survey, dual credit agreements, and other documents as needed; Conducted 12 short interviews with high school and college dual credit coordinators and other experts regarding dual credit reporting policies and practices and course crosswalks.
2	Did the population and proportion of Texas public high school graduates who took academic dual credit courses, non-academic dual credit courses, or both change from 2004 to 2007?	Using information learned from research question 1, constructed a data file of 2004 - 2007 Texas public high school graduates who took dual credit courses. Created several descriptive data tables showing longitudinal data by year (2004, 2005, 2006, 2007) and disaggregated by race, gender, economic status, region, type of high school attended (urban/suburban and rural), type of college enrollment, college freshman GPA, and persistence into the second year of college. For comparison purposes, included data for all 2004-2007 public high school graduates for race, gender, economic status, region and type of high school attended. Created tables showing data by number and percent of students who took academic courses, number and percent of students who took non academic courses, and both.
3	For the population of Texas public high school students who enroll in dual credit courses while in high school, does the average number of dual credit courses taken differ by type of courses taken (academic, non-academic or both), gender, economic status, race, region, type of high school attended, type of college enrollment, and persistence in the first year of college?	Using cohort data, conducted ANOVA analysis to identify main effects and significant F statistics. Used the total number of dual credit courses taken as the dependent variable and type of dual credit courses taken (academic, non-academic, or both), GPA, gender, race, economic status, region, type of high school attended, type of college attended, and persistence in college as the independent variables. Grouped 2004-2007 data together to increase the power of the analyses. Focused two-way interactions on type of courses taken (academic, non-academic, or both) and chose others as appropriate. Due to the number of interactions, conducted a chi square test to determine significance of regions by type of courses taken. Used Tukey-Kramer post hoc test to determine significant pairwise interactions.
4	For the population of Texas public high school students who enroll in dual credit courses, are there differences in average Grade Point Average (GPA) by type of dual credit courses taken, gender, economic status, race, region, type of high school attended, type of college enrollment, and persistence in the first year of college?	Using cohort data, conducted ANOVA to identify main effects and significant F statistics. Used college freshman GPA as the dependent variable and type of dual credit courses taken (academic, non-academic, or both), gender, race, economic status, region, type of high school attended, type of college attended, and persistence in college served as the independent variables. Grouped 2004-2007 data together to increase the power of the analyses. Focused two-way interactions on type of courses taken (academic, non-academic, or both) and chose others as appropriate. Conducted selected ANOVA analyses. Used Tukey-Kramer post hoc test to determine significant pairwise interactions (used for unequal sample sizes).

Research Question 2: Did the population and proportion of Texas public high school graduates who took academic dual credit courses, non-academic dual credit courses, or both change from 2004 to 2007?

Research Question 3: For the population of Texas public high school students who enroll in dual credit courses while in high school, does the average number of dual credit courses taken differ by type of courses taken (academic, non-academic or both), gender, economic status, race, region, type of high school attended, type of college enrollment, and persistence in the first year of college?

Research Question 4: For the population of Texas public high school students who enroll in dual credit courses, are there differences in average Grade Point Average (GPA) by type of dual credit courses taken, gender, economic status, race, region, type of high school attended, type of college enrollment, and persistence in the first year of college?

Data Gathering and Triangulation of Sources

The study sought to answer the four research questions above using a mixed-methods approach. The approach has several components, the first of which is focused on "information gathering." This portion of the study used both quantitative and qualitative methods to determine how effectively statewide K-12 and higher education databases reflect the current dual credit coursetaking picture in Texas. A preliminary review of information about dual credit and concurrent enrollment coursetaking conducted during the design phase of the project suggested sufficient differences and inconsistencies in the databases to devote a significant portion of this study to exploring data reporting and alignment issues. Using numerous methods helped ensure that data inconsistencies were identified and explained whenever possible, and also provided assurance that the data utilized in the statistical portions of the study were as reliable and valid as possible. Guba and Lincoln (1989) identify "confirmability" as the qualitative parallel to objectivity" (as cited in Mertens, 2005, p. 257). The use of many sources brought a higher level of confirmability to the findings of this study by corroborating or contradicting observations about the available data made from preliminary reviews of dual credit records in the two main primary state databases.

Differences and Discrepancies in the TEA and PEIMS Databases

TEA's PEIMS and THECB's CBM systems are the two large state databases that include student-level dual credit data. Some of the apparent misalignment between the systems may be due to their design and function. The databases were developed independently at the two agencies. Although both are education-related, the agencies have different legislative responsibilities and missions, as well as different data collection and reporting processes.

The TEA and THECB reporting systems only collect and report credits taken/attempted at their own system level (secondary or postsecondary). High schools report the high school-level courses and credits to which dual credit college courses are crosswalked; colleges report the student credit hours attempted for each college-level course taken for dual credit. A preliminary, cursory analysis of dual credit data overlaps between the PEIMS and CBM systems suggested that many students and/or course hours that are reported as dual credit in the CBM system cannot be matched to dual credit student and course identifiers in the PEIMS system and vice versa.

It is difficult to differentiate dual credit from concurrent enrollment in the THECB CBM system. While there is a mechanism to report the number of dual credit hours a high school student takes, there is no field to report concurrent enrollment hours taken by a high school student. While concurrent enrollment students could, potentially, be identified by comparing high school and college enrollment records, a planned analysis of differences in concurrent enrollment and dual credit populations was dropped from the study due to inconsistencies in dual credit reporting discovered during the research process. These inconsistencies are discussed at length in Chapter Four.

To better understand differences in dual credit reporting across the secondary and postsecondary sectors, TEA and THECB student enrollment files were merged to more accurately identify where dual credit records overlap. The analysis was conducted for students who were enrolled in a Texas public high school, a Texas public college, or both during the 2006-2007 academic year. Interviews conducted for the study and the review of dual credit crosswalks provided information which influenced the interpretation of the data comparison results.

THECB Fall 2007 Dual Credit Survey

In fall 2007, the THECB Division of Academic Affairs conducted a survey designed to gather information about dual credit practices and policies in Texas (THECB, 2007b). Forty-five two-year colleges and seventeen four-year institutions responded, including a large majority of the institutions that offer dual credit programs. Several questions were included, and information about local dual credit crosswalks was requested. Reported crosswalks that provided sufficient detail to establish specific high school and college course linkages were used in the course crosswalk analysis conducted for this study.

Collection of Local Dual Credit Agreements and Related Documents

According to THECB rules, "For any dual credit partnership between a secondary school and a public college … an agreement must be approved by the governing boards or designated authorities (e.g., principal and chief academic officer) of both the public school district or private secondary school and the public college prior to the offering of such courses" (TAC, Title 19, Chapter 4, § D). Although dual credit rules do not require agreements to be submitted to the state, in summer 2008 the THECB requested agreement templates and/or copies of dual credit agreements from all Texas public colleges and universities for reference and research purposes. The agreements were made available to the researcher. All of the agreements were reviewed, with emphasis on information about dual credit crosswalks, related coursework patterns, course articulation issues, data reporting, course location, and student eligibility for dual credit courses. The agreements are required to address, among other things, "eligible courses . . .location of class . . .course curriculum . . . and transcripting of credit" (TAC, Title 19, Chapter 4, § D).

To facilitate the effective use of the dual credit agreements received, all available course crosswalks related to the four areas TEA identifies as "foundation" areas – English, mathematics, social studies, and science – were compiled and frequencies were recorded for each specific high school to college course linkage. Technical, workforce, and other non-academic subject area crosswalks were not compiled due to the large number of courses available in those areas. In addition, unlike for academic subject areas, guidelines for course crosswalks in some technical and workforce areas are available from the Advanced Technical Credit (ATC) Program, a program which promotes workforce education programs in Texas (ATC, 2009).

Interviews

Interviews with dual credit coordinators at the secondary and postsecondary institutions were the final component of the information gathering phase of this study. Participant responses helped establish relationships between program variations and reporting practices. Insight provided by coordinators about how institutions characterize, crosswalk, and report dual credit courses to the appropriate state agency (TEA for high schools and THECB for colleges) was invaluable in understanding and interpreting state level data, course crosswalks, and dual credit populations.

A modified snowball approach was used for determining interview subjects for the study (as described in Mertens, 2005). Dual credit experts were identified through professional contacts or through interactions with coordinators who responded to the THECB request for dual credit agreements. In general, interview participants were identified at colleges, and those participants were then asked to recommend a dual credit coordinator from a partner high school. This model provided the opportunity to compare responses from individuals who were working with the same dual credit population from different vantage points.

Twelve interviews were planned and executed. Ten of the interviews were conducted over the phone, and two interviews were conducted in person. A short list of pre-prepared questions was the basis for the inquiry, although interviewees were also provided the opportunity for open-ended response. Interview questions are provided in the Appendix (A.1).

Six interviewees were college and university-level coordinators, 5 interviewees were high school coordinators or administrators with responsibility for dual credit initiatives, and one interviewee was a K-12 state administrator. The interview results are presented in Chapter Four. Gender-linked pronouns which might identify the individuals have been randomly varied, as have other potentially identifying features. The general areas of the state in which the individuals resided have been accurately identified as have the types of schools the individuals represented (college vs. university, private vs. public high school, etc.).

Longitudinal Analysis of Dual Credit Programs

A cohort of Texas public high school students who graduated in 2004, 2005, 2006, and 2007 was compiled for use in the data analyses outlined in research questions two, three, and four. The cohort was built by combining records from several data sources. Most of the data was gleaned from TEA and THECB databases using SAS programming to merge student records from different files. High school graduates for each year were determined using graduation records which had been "cleaned" so that students with invalid social security numbers were not included. The file of all high school graduates was then merged with the TEA course completion files for 2001 through 2007. Any student who had one or more high school courses coded with a dual credit flag during his or her high school years was included in the cohort, with a record included for each dual credit course taken. The list was then merged with a list of all possible course service codes and a course-type identifier which had been created by the researcher. This identifier specified whether a course was academic, fine arts, physical education, or workforce/technical. Then the number of academic dual credit courses and the number of non-academic dual credit courses were tabulated for each student. Fine arts, physical education, and workforce/technical courses were all included in the non-academic group. The file was then unduplicated so that there was one record for each student.

Once the basic cohort was constructed, additional information was added to the student records. Selected THECB college records were accessed and college enrollment, persistence, and performance data was added for each student. Additional information about high school district was also included. More detailed information about the variables used for the study is provided at the end of this chapter.

Identifying Academic and Non-Academic Dual Credit Courses

This study used a pre-established method to discriminate between academic and non-academic dual credit coursework in the PEIMS system. The method was devised by the researcher for use in a study of high school senior year academic coursework and is well-suited for the dual credit analysis (Eklund, 2007).

Each individual course in the PEIMS system is assigned an eight-digit service code that is linked to a course title. For the purposes of this study, courses listed in the Texas Essential Knowledge and Skills (TEKS) state curriculum for high-school level English, mathematics, social studies, science, and foreign language for the four cohort years being studied (2004-2007) were identified as academic courses. Courses that were not identified in the TEKS under one of these academic subject listings, but for which the title and course code indicated academic content in one of the abovementioned core areas, were also included. These non-TEKS courses were generally "innovative" courses or "magnet" courses. Innovative is a special course designation used by TEA for locally developed courses which have received state approval. Magnet courses are specialized courses offered by magnet schools or programs.

To ensure that the academic courses identified for the senior year academic coursework study (Eklund, 2007) were appropriate, the academic course code lists were provided to TEA curriculum directors with expertise in the designated academic areas at the time of that study. Recommended changes were incorporated. The resultant master list of academic course codes was used as a guideline for the code lists used in this analysis.

Changes to the Dual Credit Cohort

The cohort was adjusted to accommodate information learned from the research process once the information gathering phase was complete. The descriptive data showing dual credit course frequencies by course type included all of the courses reported for dual credit in the TEA system for students in the original cohort, with the exception of several hundred course records from one school district that were removed because they were determined to be inaccurate. All of the descriptive data about student participation and student populations was calculated using a revised cohort which included approximately 30,000 fewer students. Students were removed from the “master” data file because they could not be identified in both the THECB and TEA databases as dual credit students. The lack of alignment between the databases and more specific rationale for removing the students is presented in the results chapters.

Analysis of Variance (ANOVA)

When the information gathering and data review phase was complete, two analysis of variance or ANOVA tests were conducted using the final master cohort data files developed from the PEIMS and CBM databases. The first ANOVA test analyzed the population of 2004-2007 Texas public high school graduates who enrolled in dual credit courses during their high school years by the total number of dual credit courses taken. The second test considered the college freshman GPA of those students in the cohort who enrolled in a Texas public higher education institution upon high school graduation. For each analysis, records for four years of high school graduates were grouped into one population. Since several variables were considered in each analysis, this was done to increase the power of the analysis.

ANOVA tests consider differences among group means. Like regression, ANOVA is useful when multiple factors and influences are involved. The procedure is well suited to education research because both continuous and categorical variables can be used in the same calculation (Cohen, 2003). ANOVA looks at variations within and across independent variables related to a single dependent variable (to determine if the across group differences and interactions are significant). The test shows independent variable associations (if any) with the dependent variable.

For the first of the two ANOVA tests in this study (see Research Question Three), the number of dual credit courses taken served as the dependent, continuous variable. The independent variables, which were categorical in nature, included the type of dual credit courses taken (academic, non-academic, or both), gender, race/ethnicity, economic status, type of school district, region where the district was located, type of college attended (if known), and first-year college persistence. For the second ANOVA, college freshman GPA served as the dependent, continuous variable. The independent variables used in the first ANOVA were also used for the second model. For both ANOVAs, two-way interactions were measured for type of courses taken (academic, non-academic, or both) and each of the other independent variables, except region. Gender and race/ethnicity, economic status and race/ethnicity, economic status and type of high school attended, and economic status and type of college attended were also included in both models. While the original study design included the interaction of region and course types, because of the large number of individual interaction observations (30) and the potential for overloading an already variable-laden model, the interaction of region and type of courses taken was investigated with a chi square analysis. Chi square looks at categorical variables and determines whether or not the variable distributions fit an expected theoretical distribution. Using a chi square test, the null hypothesis can be confirmed or disproved at an established level of significance.

The ANOVA tests were conducted using SAS statistical software. A Tukey-Kramer post hoc test was included in the ANOVA model to test for honestly significant differences (HSD). This test "is an extension of the Tukey test to unbalanced designs

[and] is less conservative for only slightly unbalanced designs and more conservative when differences among samples sizes are bigger" (SSTARS, n.d., ¶ 11). The Tukey-Kramer is a good choice for this study given the large sample size and unbalanced design. Pairwise interactions were identified and discussed.

The results for Type III Sum of Squares were used in the analysis so that the entire model was considered in determining significance and in calculating effect sizes. The study used a conservative .01 significance level to try to prevent Type I error. However, the very large population size in the study did increase the likelihood of Type I error, a "false positive," that occurs when the null hypothesis is disproven, but is actually true. An omega squared (ω^2) was used to test for effect size. Results of this test provided guidance as to the practical significance of ANOVA results.

Access to CBM and PEIMS databases

As the researcher was employed as a Student Policy Fellow at THECB during the time of this research, she was granted access to relevant portions of the PEIMS and CBM databases through the agency. Permission was granted from TEA for the researcher to access student high school course completion records and other demographic data available on the TEA high school graduation record.

Data about student enrollment in private universities was available from student records collected by THECB from independent colleges and universities in the state. Freshman GPA data was only available for Texas public college and university enrollees; college enrollment and persistence data were available for students who attended both public and private colleges in Texas, but not for students who attended out-of state institutions.

Variables

For the two ANOVA analyses, dual credit populations in Texas were identified by several variables: gender, ethnicity, economic status, region, type of high school attended, type of college enrollment, persistence in first year of college, and college freshman GPA.

Economic Status

Economic status was determined using free or reduced lunch records in the PEIMS database. Students who received a free or reduced price lunch or were otherwise categorized as economically disadvantaged in the PEIMS system were classified as economically disadvantaged in this study. Students who did not fall into a category designating economic disadvantage were classified as not economically disadvantaged. Although using free or reduced lunch status to classify students' economic status can be inaccurate, particularly for high school students who may choose not to be identified in this way, this measure of economic status is both well-accepted and commonly used in the Texas education community. For example, the extensive state K-12 accountability system uses this measure as a proxy for economic status.

Gender, Race and Ethnicity

Gender status was taken from TEA graduation records. Race/ethnicity was also determined from TEA records which provide five categories: Native American, Asian/Pacific Islander, African American, Hispanic, and white (non Hispanic). All students are classified in one of these categories in TEA records; there is no “other” or “unknown” category used.

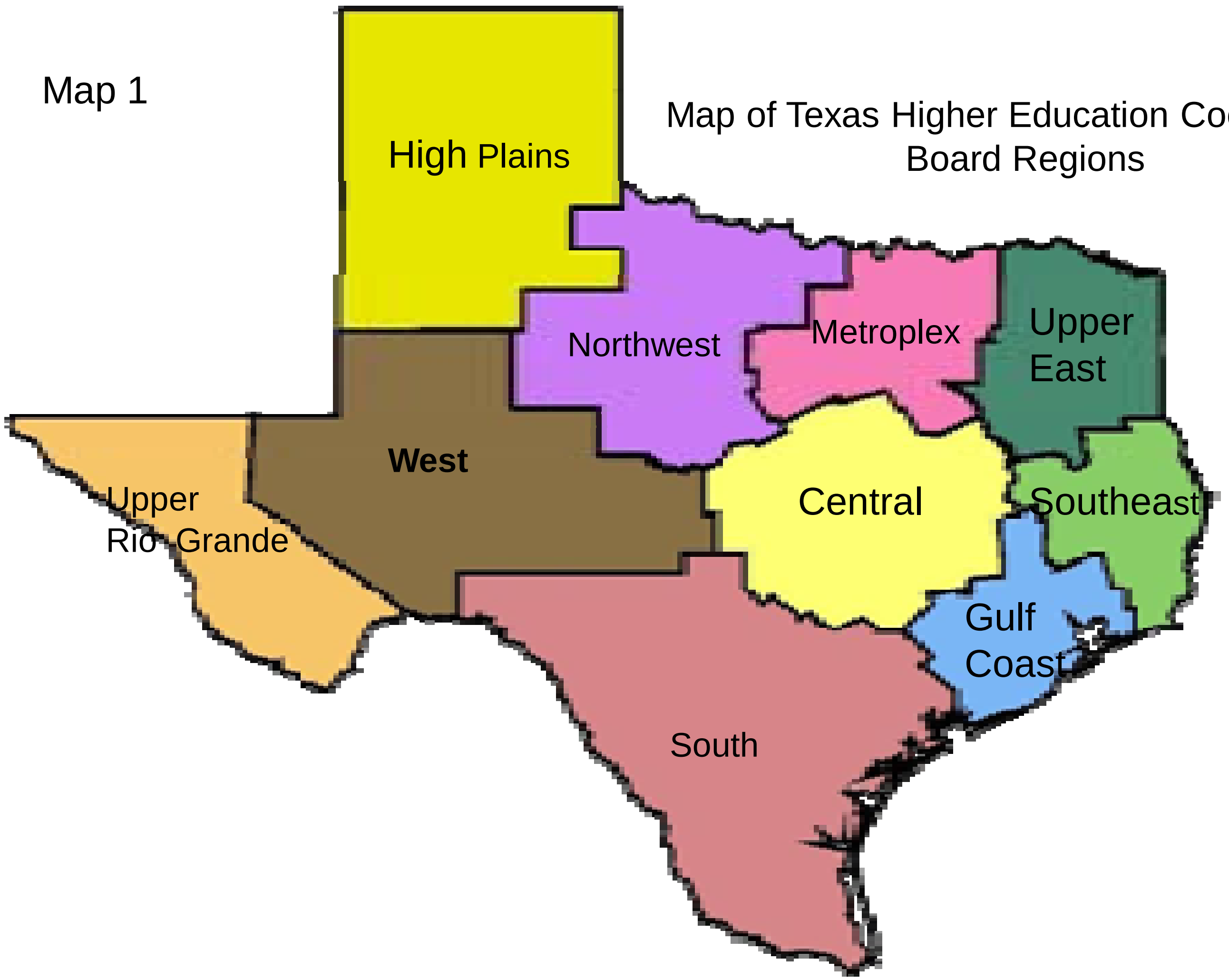
Dual credit is seen by some as a way to encourage minority and low income student participation in the college experience and to provide these students with credits that will reduce the financial burden that attending college may cause. Karp and Bailey (2007) found that “male and low-income students benefited more from dual enrollment participation than their peers” (p. 7). Because male college-going rates lag behind women’s ("For Every 100 Girls," 2006), and minority men have lower college enrollment rates than many other groups (THECB, 2009) , it is important to look at these demographic characteristics to see at what level dual credit programs serve these populations and if program growth involves these participants.

Geographic Region

Geographic region was another important variable in this study because dual credit programs are developed at the local level and vary from region to region. The geographic areas utilized in the study were the ten existing “higher education regions” identified by the THECB. A map of these regions is provided on the following page. The high school where a student was enrolled at the time of graduation was used to determine the student’s region of residence. Since the majority of dual credit courses are taken at or

Map 1

Map of Texas Higher Education Coordinating Board Regions



through a local or regional higher education institution, the region in which the student attended high school was generally the region where the student took dual credit courses.

Type of High School/District

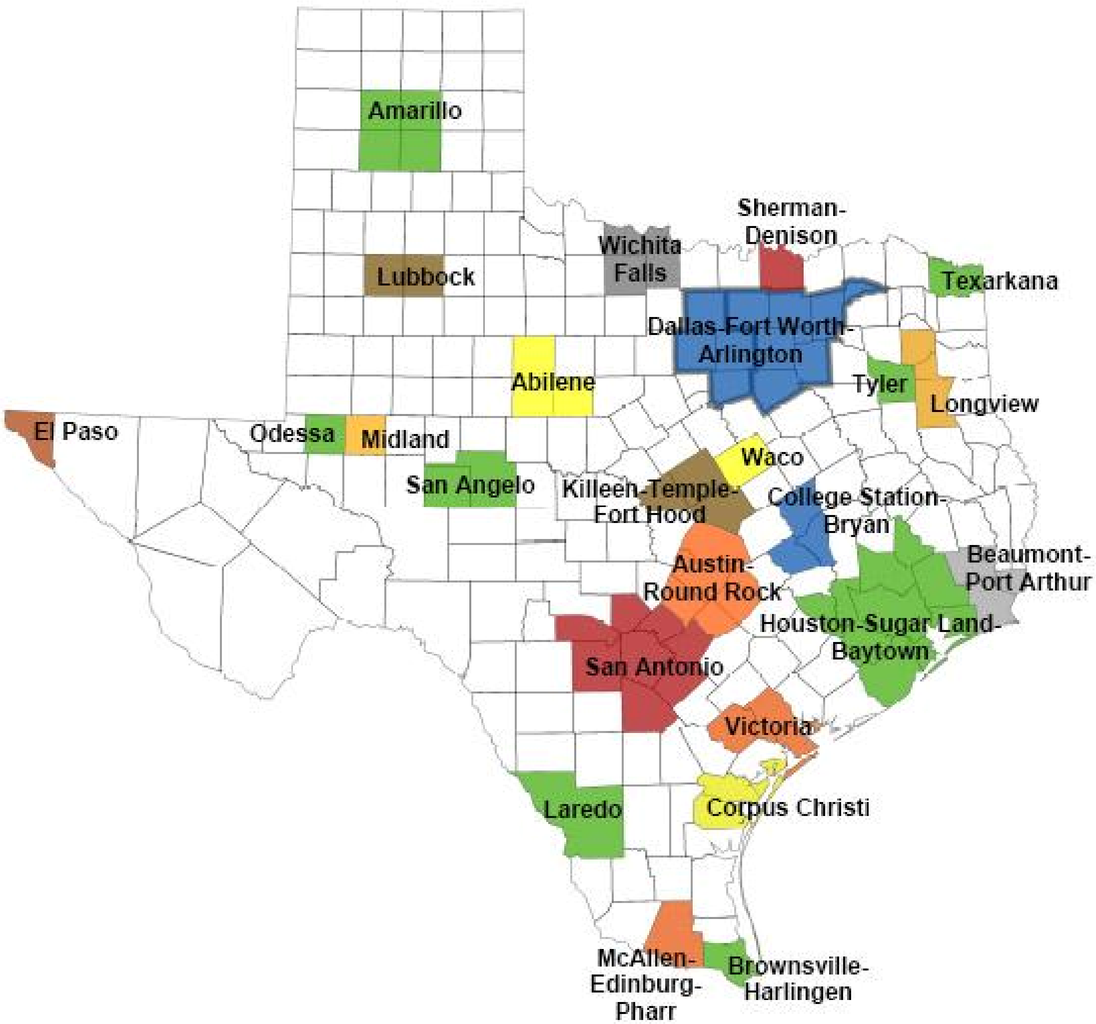
A means to differentiate types of high schools/ school districts was designed for this study. Educational research frequently identifies inequalities between schools of different types. Urban schools that enroll predominantly low income and minority students often do not have the level of resources that are available to their wealthy suburban counterparts. Rural schools, because of their small size and/or large drawing radius, frequently have limited facilities and narrow course offerings. Understanding variability in dual credit populations by high school district type provides a window into the kinds of opportunities students are being provided.

Waits, Setzer, and Lewis (2005) used national survey data to examine differences in types of dual credit coursetaking across types of schools and found several differences between small, medium, and large schools and city, urban fringe, suburban and rural schools. For example, suburban schools made dual credit programs available most often, and schools in or near cities were more likely to offer dual credit courses on a college campus than were schools in rural areas.

The Texas Education Agency has a complicated system for identifying schools and school districts by their location and other demographic characteristics of the school and/or area population. There are nine categories of schools in the TEA matrix, a level of gradation that would have impeded rather than enhanced this study (which already includes several variables). Therefore, three types of school districts were distinguished for this study using a method devised by the researcher. The Texas State Data Center differentiates Texas counties by Metropolitan Statistical Areas (MSAs) and non MSAs. These data were accessed and used to differentiate urban/suburban high schools from rural schools. All high schools in a district located in an MSA area were considered urban/suburban schools and all high schools that were not located in an MSA area were considered rural schools. A map of the MSAs is provided on the next page. High schools within MSA areas were differentiated by district student performance on the college readiness measure in the TEA Academic Excellence Indicator System (AEIS).

TEA publishes information about the percent of students in each school district who achieve the state-established higher education readiness score on the TAKS, SAT, or SAT. This measure, used to determine the readiness of Texas public high school students to take college-level courses, is aligned with the readiness requirements for academic dual credit courses in THECB rules. To differentiate high performing from low performing urban and suburban high schools, a standard of 45 percent or more of all students meeting the college-readiness score in all subject areas (mathematics, reading, and writing) was set as the cut-off point for designating a district as urban/suburban high readiness (U/S HR). Districts where fewer than 45 percent of all students met the higher education readiness standard were determined to be urban/suburban low readiness schools (U/S LR). This analysis allowed districts like Highland Park in Dallas, Eanes in Austin, and Alamo Heights in San Antonio – urban school districts with very high readiness levels – to be classified as U/S HR. Likewise, lower performing districts in

Metropolitan Statistical Areas, 2003



Source: Texas State Data Center

more suburban areas are classified as U/S LR. Rural areas also vary in terms of student performance on the higher education readiness standard noted above, but this distinction was not used for rural schools because 87 percent of the rural school districts were low performing based on the measure.

Type of College Enrollment

Type of college enrollment was determined using THECB enrollment records. Students were included in the cohort if they enrolled in college during the fall immediately following high school graduation. Students who did not attend a public or private college in Texas were listed as “unknown.”

Persistence in College and Freshman GPA

College persistence and college freshman GPA were outcome measures included in the study. Persistence is the measure that follows a student from the time of enrollment (the fall following high school graduation) to enrollment the following fall. College GPA was measured as a continuous variable in the ANOVA analysis and GPA means were provided by graduation year in the descriptive analysis.

Summary

The use of multiple sources of data added a valuable dimension to this research as did the P-16 origins of the data sources. Exploring data within the context of policy and practice was an excellent way to discover the nature of dual credit programs and participation in Texas. The results of this exploration are presented in the next two chapters.

CHAPTER FOUR: MULTI-SOURCE EXPLORATION OF DUAL CREDIT

Overview

This study used a mixed-methods approach to examine dual credit data quality and data alignment, coursework patterns, and student populations in Texas. An exploration of dual credit data alignment across Texas' K-12 and higher education reporting systems, the charting and analysis of dual credit course crosswalks, a document review of dual credit partnership agreements between high schools and colleges, and interviews with several high school and college dual credit coordinators, established a clearer picture of dual credit programs, students, and practices. As anticipated, this multi-faceted approach added complexity to the analysis. However, it also allowed for a more robust understanding of the dual credit data available at the time of this study, as well as the programs and students the data were designed to capture.

This chapter presents study findings that inform Research Question 1: Do current statewide reporting systems provide consistent, accurate, and useful data about student enrollment in dual credit and concurrent enrollment courses? The results begin with a comparison of dual credit data collection and data alignment across the two major state databases used in the study: the Texas Education Agency (TEA) Public Education Information Management System (PEIMS) database and the Texas Higher Education Coordinating Board (THECB) Coordinating Board Manual (CBM) reports database. Alignment concerns and accuracy and consistency issues are included in an exploration of dual credit reporting practices which includes a discussion of reporting patterns from a variety of high school and college types and reporting issues related to dual credit versus concurrent enrollment. Following this comparison, results of the crosswalk analysis, dual credit partnership agreement study, and dual credit coordinator interviews are presented. Information from these activities provides context for the data analyzed in this and later chapters and helps highlight the strengths and weaknesses in the data and in current dual credit data reporting and collection processes.

Although the findings from the data alignment study, crosswalk analysis, dual credit agreement review, and interviews are generally presented separately, the results are intricately woven, and common themes emerge which are discussed as appropriate throughout the chapter. The findings presented in this chapter were integral to the construction of a comprehensive data file which was used for the quantitative analyses of statewide dual credit data outlined in research questions 2 to 4. The components of that data file and the results of the descriptive and statistical analysis of the data therein are presented in Chapter Five.

TEA and PEIMS Dual Credit Data

Diversity of Dual Credit Participation Opportunities

In Texas, dual credit coursetaking crosses public and private school boundaries at both the K-12 and higher education levels. It is important to understand the diversity of participation opportunities when considering statewide dual credit data. Opportunities to take dual credit courses at Texas public colleges and universities are open to Texas public high school students (including charter school students), private school students (from independent and parochial schools), and home-schooled students. The THECB system provides an avenue for colleges to report dual credit student contact hours taken by students from all of these high school types through the dual credit hours field in the CBM001 report. Opportunities for public high school students to take dual credit courses are also varied and include courses offered by Texas public two-and four-year colleges, Texas private colleges and universities, and out-of-state institutions of higher education. The dual credit flag in the TEA PEIMS data system is the mechanism used for identifying specific high school courses for which dual credit is received. Because high school course records are linked to individual student records in the PEIMS course completion record, students who participate in dual credit programs can be identified through the dual credit flag in this required report.

Dual Credit Data across TEA and THECB Databases

An exploration of dual credit data accuracy, consistency, and usefulness in Texas must, by necessity, take into account the myriad options for dual credit course participation in Texas. As noted above, dual credit programs cross the public and private education sectors at both the K-12 and postsecondary level. In the public sector, THECB only collects data on dual credit hours attempted at the college level and TEA's dual credit records only report the high school course for which dual credit was received. Neither TEA nor THECB collects information on the partner institution where credit was attempted, and private high schools and colleges do not report dual credit data to state institutions. This makes data alignment across programs types difficult, including within the public education realm and across the public/private education divide. This section utilizes comparisons of dual credit data across the systems.

Summer Enrollment in Dual Credit Courses

A major drawback of the TEA PEIMS system is that the agency collects course completion record data for academic year enrollments only. Therefore, there is no means to track dual credit summer coursetaking across the PEIMS and CBM databases. Since the TEA database is the only one of the two major databases that provides information about the types of courses taken for dual credit, information about specific course participation (course titles and types) is unavailable for any summer dual credit courses. THECB CBM records, as noted previously, track enrollments of students from both public and private high schools. For the summer 2007 semester, summer dual credit hours attempted by high school students at Texas public colleges and universities totaled 55,812. This is approximately 12 percent of the total dual credit hours attempted in the 2006-2007 academic year (THECB, 2007a).

Differentiating Dual Credit and Concurrent Enrollment Hours

A major drawback in the THECB reporting system is the lack of a good mechanism for tracking dual credit versus concurrent enrollment hours. The CBM001 report does not have a specific category for reporting concurrent enrollment hours, defined in this study as hours attempted by a student who is enrolled in high school and takes a class or classes for college credit alone. Because students who take courses at Texas public colleges and universities must be reported to the state for funding purposes, credit hours are reported at the student level for all enrollees. By comparing student enrollments across the TEA and THECB databases it is possible to identify students who are enrolled simultaneously in both systems, even if dual credit hours are not reported by either, or only reported by one of the two systems. Non-public high school enrollees who take college courses can only be identified as high school students in the CBM system if their hours are recorded as dual credit since no high school records are available for determining high school enrollment.

Evidence gathered in the interviews conducted for this study suggested that at the higher education level it is difficult for administrators to determine if high-school enrolled students are earning dual credit or college-credit only. Interviews also revealed misunderstandings on the part of some college personnel about how dual credit and concurrent enrollment are defined in the system, and consequently how they should be reported to the THECB. Thus, the potential for significant misreporting of dual versus concurrent enrollment hours at the college level is very high. College dual credit experts interviewed reported that it is especially difficult to differentiate between the two coursetaking types in the summer semesters. This is because they often did not know if a student was taking a summer course for dual credit or concurrent enrollment credit. Also, a student may take a course during the summer and petition his or her school for high school credit when returning in the fall. By the THECB definition, the course would be considered concurrent enrollment because the student did not *simultaneously* earn credit for two courses. However, non-simultaneous courses are acceptable in the TEA definition of dual credit, so dual credit may be awarded.

Using a Matrix to Understand Dual Credit Enrollment Patterns and Data

The matrix in Table 4.1 on page 116 provides a visual guideline for understanding variations in dual credit enrollment and reporting across the TEA and THECB databases and provides data to support some of the reporting concerns already mentioned above. Data for fall 2006 and spring 2007 enrollments at Texas public high schools and colleges were disaggregated by matrix category for the purpose of providing a numeric context for understanding each enrollment category and to highlight possible discrepancies in dual credit reporting. No summer data were included. Configurations with a likelihood of high misreporting error are noted in the appropriate matrix cell and explained further in the upcoming discussion. For matrix cells where no count or data were available, the text provides an explanation of students who would, hypothetically, be included in that category.

In the matrix data, student enrollments are examined rather than individual course enrollments. Each student is represented only once. Therefore, although a student may fall into more than one category for different types of dual credit coursetaking during the same period, the student is reported in the category for which the most information was available. For example, a student might have had a TEA record with two courses flagged for dual credit and a THECB record with three dual credit semester credit hours reported. This student would show up on the matrix in cell 1, the category of students for whom dual credit was reported by both agencies, and not in cell 7, although it is likely that the student also took a course which was reported for dual credit in the TEA system and not reported with dual credit hours in the THECB system, since only three hours of dual credit were reported in the CBM database.

Table 4.1. Enrollment of High School Students in College Courses Fall 2006-Spring 2007

Record Type	TEA Record w/Dual Flag (s) (Column Total : 60,583)	TEA Record w/ No Dual Flag(s)	No TEA Record (Private/Home Schooled)
THECB Record w/Dual SCH (Row Total: 68,003)	1. **42,306 Students** Dual Credit at TEA; Dual Credit at THECB	2. **17,532 Students** Dual Credit at THECB; Enrolled at TEA (mismatched enrollments or misreporting)	3. **8,165 Students** Dual at THECB; No TEA Enrollment (Dual Enrollment of Private HS Students)
THECB Record w/ No Dual SCH	4. **2,431 Students** Dual Credit at TEA; Enrolled at THECB (mismatched enrollments or misreporting)	5. **4,510 students** Enrolled at THECB; Enrolled at TEA (no dual at either)	6. **No Count Available** Enrolled at THECB; No TEA Enrollment (Concurrent Enrollment of private hs students)
No THECB Record	7. **15,846 Students** Dual at TEA; No THECB Enrollment. (Public high school/private college enrollment or misreporting)	8. **No Count Available** Enrolled at TEA; No THECB Enrollment (Concurrent Enrollment at private college)	9. **No Data Available** No TEA Enrollment; No THECB Enrollment (Private HS students enrolled in private colleges)

Enrollment in Public High School and Public Higher Education Institutions

The four-celled area in the upper left corner of the matrix (cells 1, 2, 4, and 5) shows dual credit enrollment variations for students who are reported in both systems. These cells provide useful information about dual credit enrollments because comparisons can be made across databases. However, the lack of direct linkages between students and courses must be kept in mind. This lack of direct linkages is the primary reason that students and not individual courses are tracked in the matrix.

Private High School/Home School and Private College Dual Credit Enrollments

The cell in the lower right hand corner (cell 9) represents high school students for whom no statewide enrollment data are available for high school or college. This includes students from private high schools or home school situations who take dual credit or concurrent enrollment courses at private or out-of-state higher education institutions. No state-level data are available about these students' dual credit participation, and public sector dual credit policies may have little or no influence on their dual credit activities.

Private High School/Home School and Public College Dual Credit Enrollment

Using the dual credit contact hours field in the CBM001 and TEA enrollment data it is possible to estimate dual credit coursetaking for non-public school students. Cells 3 and 6 in Table 4.1 represent students who were enrolled in private high schools or were home schooled and who took dual credit courses (cell 3) or concurrent enrollment courses (cell 6) at public higher education institutions. For the 2006- 2007 academic year, 12 percent or 8,165 of the 68,003 students who were reported by public higher education institutions with dual credit semester credit hours were not enrolled in a Texas public high school during the same period. The finding that a significant percentage of private/home schooled school students participate in dual credit programs at public institutions of higher education is also supported by the dual credit partnership agreement review conducted for this study. Over 50 percent of the institutions that submitted agreements reported dual credit partnership agreements with private or parochial high schools and/or home schools. The growth of home schooled high school students' participation in dual credit programs was also confirmed by the dual credit coordinators interviewed for this study. Policy makers who address dual credit participation must keep in mind the significant participation levels of private and home-schooled students who enroll in these programs.

While private or home schooled students may take college level courses for college credit only and be reported in the THECB system (cell 6), without a record that links their high school status to contact hours on the CBM report, there is no means to identify these college enrollees as high school students.

Private and Out-of-State Dual Credit Options for Public High School Students

For students enrolled in Texas public high schools, dual credit courses may be taken at private Texas colleges and universities as well as public or private out-of-state institutions. While THECB requires that dual credit students be enrolled simultaneously in a high school and college-level course, TEA requirements allow students to receive high school credit for a college course that was taken in a different semester.

THECB collects limited enrollment data from Texas private colleges and universities, many of which are the beneficiaries of state financial aid funds for Texas residents; however, the agency does not collect information on credit hours attempted by students enrolled at private institutions. The Independent Colleges and Universities of Texas (ICUT) Association was contacted during the research phase of this study to learn more about the availability of dual credit course options at Texas private colleges and universities. The association provided the results of an unpublished 2007 survey of Texas private institutions on dual credit programs (ICUT, 2007). Although the survey did not provide enrollment frequencies for dual credit courses, the available results indicate that many Texas private colleges do offer dual credit opportunities to high school students. Of the 31 private colleges who responded to the survey, 24 reported dual credit course availability on their campuses; of those, seven offered summer dual credit course opportunities.

One method to determine the approximate number of public high school students who enroll in dual credit courses at private colleges is to compare public high school and public college enrollment records for the same enrollment period. Since a public school student may be enrolled in both a private and a public college for dual credit at the same time, any comparisons of enrollments will be limited by the inability to track specific course connections across the systems. Cell 7 in the Table 4.1 matrix represents students who receive dual credit for a Texas public high school course or courses but who are not enrolled in a Texas public college during the same period.

During the 2006-2007 academic year, 26 percent of the total number of students who were reported as enrolled in one or more dual credit courses in the PEIMS course completion record were not reported as enrolled by a Texas public college or university. Although the ICUT survey results showed that a significant number of Texas private higher education institutions offer dual credit opportunities to high school students, this high percentage appears problematic. Only about ten percent of the total college enrollments in Texas are at private institutions (THECB, 2009). A dual credit population that includes over one-quarter of the students only taking courses at private or out-of state institutions appears inconsistent with this general enrollment statistic. The fact that dual credit students are often charged full or half tuition at private institutions adds to the unlikelihood that this statistic is correct (ICUT, 2007).

Misreporting of Articulated Credit Courses in the TEA System

Further research into the dual credit courses taken by public high school students who were not enrolled simultaneously at a Texas public institution for the 2006-2007 academic year revealed that over half of these dual credit courses were workforce or technical courses. These are courses that are generally not offered by private four-year institutions in Texas. Inquiries about this finding were directed to a TEA subject area expert who responded that TEA staff members believe there has been significant misreporting of articulated credit courses as dual credit courses in the PEIMS system. Articulated credit courses are technical high school courses for which a student will receive college credit upon high school graduation and enrollment in a specific community or technical college.

In response to concerns about articulated credit courses being misreported as dual credit courses, changes have been made to the PEIMS reporting standards for articulated credit beginning in the 2009-2010 year. Specifically, a new reporting flag for articulated credit courses has been introduced and a reporting error will be generated if a school district flags a course as both dual credit and articulated credit. This will greatly reduce the likelihood of misreporting in the future.

Concurrent/Dual Credit Reporting Discrepancies

Dual credit and concurrent enrollment reporting differences emerge when studying the overlapping TEA and THECB data in the Table 4.1 matrix. The data in cells

1, 2, 4, and 5 highlight enrollment variations for students who were enrolled in both public high schools and public higher education institutions in fall 2006 and spring 2007. Overall, 66,779 students are represented in these four overlapping enrollment categories. As noted previously, no student is duplicated, but a student may fall into more than one category and only be represented in the one where most information was available. Because TEA and THECB use their data reporting systems to determine funding for students and schools, accurate reporting of student enrollments is critical for the smooth functioning of both systems. Both agencies are known for their excellent data resources. While THECBs college enrollment data accurately captures student participation, the data do not appear to distinguish well between dual credit and concurrent enrollment contact hours.

Of the 1,265,479 students identified as enrolled in Texas public high schools in the PEIMS 2007 course completion record (fall 2006 and spring 2007 enrollment), 60,583 of these students were reported by TEA as taking at least one dual credit course. A total of 44,737 of these dual credit-flagged students were reported as taking one or more credit hours by a Texas public higher education institution during the same period. An additional 22,042 students who were enrolled in a public high school during this period were also reported as enrolled at the THECB. These students were not flagged in the TEA system as taking dual credit during the academic year in question.

Relatively few public high school enrollees show up in the THECB system with no record of dual credit contact hours. In other words, for most students who are enrolled in a public high school and public college at the same time, their college enrollments are reported with dual credit contact hours. For the 66,779 students who overlap in both systems, THECB enrollment records included 59,838 students with dual credit contact hours and 6, 941 students with only non-dual credit college hours reported.

It would be logical to assume that for students who are reported as enrolled in both systems, students taking dual credit courses would be recorded as such in both systems and students taking concurrent enrollment courses would have no dual credit hours or dual credit flags reported in either system. However, given the possibility for non-public school students to show up in the system at either level, and the fact that students (but not courses) can be linked across systems, one would expect to find some students whose course records are misleading. For example, a public high school student may have a private college dual credit course flagged as dual in the TEA system and might also take a concurrent enrollment course during the same semester at a public community college. In the matrix, the student would be represented in cell 4 with dual credit flagged at TEA and enrollment without dual credit hours reported to the THECB. In actuality, the student would fit into two cells for the two different courses: cell 7 (TEA with dual flag, no THECB enrollment) and cell 5 (TEA with no dual flag, and THECB with no dual hours). Rather than the misreporting of a course, which this could appear to be in the data, the student actually took two courses.

Scenarios for inaccurate reporting in cell 2 (CB with dual credit hours and TEA with no dual flag) are more difficult to construct. While it is possible that a public high school student may take courses at both a private and public college, it is unlikely that a student enrolled in a public high school is also enrolled in a private high school at the same time. Therefore, the students in cell 2 who are reported as enrolled in a public high school with no dual credit hours flagged and enrolled in a public college with dual credit hours reported suggests significant misreporting of concurrent enrollment students as dual credit participants. Given interview feedback that colleges frequently have difficulty ascertaining whether a high school student is taking a course for dual credit or concurrent enrollment, many of the 17,532 students in the cell 2 category may be concurrent enrollment students who are mistakenly reported with dual credit hours in the CBM system. The other possibility is that the students were, in fact, receiving dual credit for a high school course but the high school neglected to use the dual credit flag when reporting in PEIMS.

Cell 5 in the Table 4.1 matrix includes students who are enrolled in both systems but who are not reported as taking dual credit by either. While the 4,510 students in this category probably are concurrent enrollment students (neither system claims them as dual), the number of students who truly fall into this category may be misrepresented because of the likelihood presented above that a large number of concurrent enrollment students are misreported as dual credit in the CBM system.

Implications for Study Design

While overlap in reporting across the TEA and THECB systems could potentially be used to differentiate dual credit and concurrent enrollment students, the enrollment comparison data and interview findings suggested that it may be difficult for colleges to report the distinction with accuracy. Based on this finding, a planned analysis of differences in dual credit versus concurrent enrollment student populations in Texas was dropped from the design for this study.

As noted earlier, the data shown in the matrix also suggest that there may be incorrect reporting in the PEIMS system, particularly with regard to articulated credit courses. As a result of these findings, the study design and construction process for the comprehensive data file for the statistical analyses were altered. Overall, much was learned from comparing overlapping dual credit enrollment data across the TEA and THECB systems. However, the data is limited because there is no means to directly link students to specific courses across the systems and because each system tracks a somewhat different population of students.

Academic and Non-Academic Coursetaking Data

Comparing overlapping enrollment and dual credit reports in the TEA and THECB databases provided some information about the quality of the dual credit data available for study. As has been noted previously, CBM data provides no information as to the type of college course for which a student receives dual or concurrent credit. In the TEA system, however, a dual credit flag does link high school course codes and titles to dual credit participation. Given the TEKS requirements that a student may not be awarded high school credit for a college course unless it "meets or exceeds" the requirements of the Texas Essential Knowledge and Skills for the course, a content link between the courses for which high school and college credit is awarded can be assumed. The crosswalk analysis discussed in the next section provides information about dual credit course linkages that cannot be obtained from state data.

Dual Credit Course Frequencies

In order to better comprehend the results of the dual credit crosswalk analysis, it is important to understand which high school courses are reported for dual credit. To do this, coursetaking data from a cohort of 2004-2007 high school graduates developed for this study were analyzed by course type and title. Based on the dual credit flag in the PEIMS reporting system, this group of public high school graduates took 242,253 dual credit courses. Multiple semester courses were reported once per student and the data included only students with valid social security numbers. The course data included all dual-credit flagged courses taken except for a few clearly misreported titles (see Chapter 5 for more detail). For the descriptive and inferential statistical portions of the study, the cohort size was reduced to include only dual credit students reported in both systems.

Table A2 in the Appendix shows the results of the course frequency analysis. Course codes and titles are listed in descending order by frequency of dual credit enrollments. The results are disaggregated by graduation year to show trends across time. Courses with fewer than 50 students reported for dual credit are not included to limit the length of the list. The list also includes a designation for each course that indicates if it was determined to be academic or non-academic for the purposes of this study (see Chapter Three for more detail).

Breakdown of Academic and Non-Academic Courses

Table 4.2 below provides an aggregated picture of the dual credit courses taken by the 2004-2007 cohort. The table includes a breakdown of the non-academic course category to provide more detailed information about the levels of coursetaking in the areas of fine arts and physical education. Coursetaking levels in these areas were a small percentage of the total number of dual credit courses taken. Overall, of the 242,253 courses reported, 87 percent were in academic subject areas (English, math, social studies, science, and foreign languages) and 13 percent were in courses designated as non-academic. As can be seen by the course titles in the frequency listing (Table A2), many of the non-academic courses were technical or workforce-related, with approximately one percent of all courses falling into the fine arts and physical education designations.

Table 4.2

2004-2007 Texas Public High School Graduates - Number of Dual Credit Courses Taken by Course Type

Course Type		Graduation Year **2004**	**2005**	**2006**	**2007**	**Total**
Academic	English, Social Studies, Math, Science and Foreign Language	45,375	48,905	54,473	62,081	**210,834**
Non-Academic	Fine Arts	353	387	426	460	**1,626**
	Workforce/technical/other	6,041	5,816	6,843	9,931	**28,631**
	Physical Education	450	207	215	290	**1,162**
Total		**52,219**	**55,315**	**61,957**	**72,762**	**242,253**

Dual Credit Crosswalk Analysis

A dual credit crosswalk refers to the linked high school course and college course for which dual credit is awarded. Although generally, “the college course replaces the high school course and the student receives credit for both” (Hoffman et al, 2008, p. 6), in Texas the expectation is that the college course will “meet or exceed” the expectations of the state curriculum for the linked high school course. This can mean different things for different institutions, instructors, and courses. However, there is an expectation that an effort has been made to review the college course content before a determination is made as to which high school course will be aligned with the college course. In some instances, content is added to the college course or the course is slightly altered to meet high school curricular requirements. According to the dual credit coordinators interviewed, this is much more common when a high school teacher (who is contracted by the college) provides the course on a high school campus than when a course is offered on a college campus.

Information about dual credit crosswalks was acquired in three ways for this study. Dual credit crosswalks were included in several of the dual credit agreements collected from colleges and universities. Crosswalks were also gathered from a dual credit survey done by the THECB in the fall of 2007 (THECB, 2007b). Finally, in a few cases, lists of course crosswalks were found on college websites.

Why Study Dual Credit Crosswalks?

Analyzing course crosswalks provides information about dual credit coursetaking patterns. The THECB CBM data reporting system does not collect information on specific courses for which a student earns dual credit hours. While the TEA PEIMS system does link course identifiers with a dual credit flag, there is no means to link high school courses to college classes. Studying available lists of crosswalks from dual credit agreements and other sources provides insight into what high school and college courses are linked. Information about the nature and frequency of high school courses that are commonly reported for dual credit, combined with available information about course crosswalks, provides a means to gain a state-level understanding of which college courses are taken by high school students and how those courses are aligned to the high school curriculum.

The course crosswalks found in dual credit agreements were the most accurate and consistent of the crosswalks used in this study. For the limited number of partnership agreements that did include crosswalks, the crosswalks reported were generally unique for each high school partner. This highlights the significant variation in crosswalks within the same college service area. The crosswalks reported on the survey were not always clear. While some colleges provided specific course names or PEIMS course code numbers for each high school link, in many cases the high school course listed was vaguely identified. For example, a course was reported as "high school English" or "high school algebra." Generally the college links were more specific. Any crosswalk that could not be reasonably identified with a specific high school and college course title was not used in the analysis. The lack of information about high school courses reported by some college survey respondents was not surprising. Both the partnership agreements collected and interviews with dual credit coordinators supported the fact that college personnel are not always aware of the specific high school course for which students receive dual credit.

Course Crosswalks by Academic Subject Areas

Course crosswalks were examined in the four TEA "foundation" subject areas: English, mathematics, social studies, and science. High school course frequency tables by subject area for dual credit courses taken by the 2004-2007 graduation cohort in these subject areas are shown in table A3 in the Appendix.

A total of 987 individual course crosswalks were tracked for this analysis. The total represents each time a specific crosswalk was recorded and reflects duplication of reports if the same crosswalk was reported several times by different institutions. For example, each time the high school Government course (03330100) was linked to the college Government course (GOVT 2301), the link was recorded. This allowed for tracking frequencies to determine which crosswalks were the most common.

The breakdown of course crosswalks by course subject area is provided in Table 4.3 below. Of the crosswalks recorded, 366 came from dual credit agreements received from 12 colleges and universities and 621 were recorded in survey responses from 38 higher education institutions.

Table 4. 3.
Course Crosswalks by High School Subject Area

Subject	Source		Total
	Agreements	Survey/Other	
English	83	99	182
Math	52	110	162
Social Studies	150	309	459
Science	81	103	184
Total	366	621	987

Two higher education institutions provided information about course crosswalks through both sources. Because the information did not match (the agreements indicated the existence of several additional crosswalks that were not included in the survey responses), both sets of data were included in the analysis. The overlap for these institutions was 40 courses or about four percent of all crosswalks recorded. Information about crosswalks gleaned from coordinator interviews also revealed a lack of consistency in crosswalking dual credit courses within some high school and college partnerships. This will be discussed in greater detail later in this chapter.

Tables 4.4, 4.5, 4.6, and 4.7 show subject-specific results for the crosswalk analysis. The tables are included with each subject-area discussion. High school courses are listed on the left side in order of the frequency with which the course was reported in the PEIMS system (see Table A3). Comparing the high school course frequency table with the crosswalk analysis data helped determine the accuracy and consistency of PEIMS dual credit reporting. For example, for students who graduated from high school in 2004, Algebra I was reported as a dual credit course for 142 students; by 2007 only 59 students in the state were reported as taking dual credit Algebra I. Not a single agreement or survey response reported a crosswalk between Algebra I and a college course. This suggests that high schools are either misreporting Algebra I as dual credit, or they are less likely to link Algebra I with a college course than in previous years. Since the content of college algebra is generally seen to be more rigorous than the higher-level Algebra II high school course, it is encouraging that Algebra I reports have dropped and that no partnerships reported using this linkage.

In each of the crosswalk tables, arrows show the linked courses reported in the crosswalks. Bold line arrows show the most frequently cited crosswalk or crosswalks for a given high school course. The broken line arrows represent less commonly reported crosswalks for that same high school course. The solid arrows (not in bold) are used when all of all of the crosswalks for a high school course are reported with the same or a similar frequency. Note that this is common with independent study courses.

Dual Credit Crosswalks and Course Length

As evidenced in the crosswalk tables, course lengths vary across the high school and college spectrum. College courses are typically one-semester in length. The TEA TEKS curriculum guidelines suggest that each one-semester college course that a high school student completes is the equivalent of one ½ unit high school course (typically a one-semester course). Therefore, a one unit high school course (typically a full-year course) is generally crosswalked with two college courses. The crosswalks tracked in the study usually reflected the recommended one unit (high school) to two courses (college) link. The actually courses which were crosswalked were not, however, as consistent. In most instances, the high school courses studied were aligned to several different courses at the college level and vice versa. Examples of this, and other highlights of the crosswalk analysis, are provided below by subject area.

College Course Numbering in the Dual Credit Crosswalks

Academic Course Guide Manual Course (ACGM) titles and codes are used in the discussion of college courses. The ACGM is Texas' common course numbering system for lower-division college courses. Public two-year colleges are required to use these codes; universities are not. For consistency, when unique university course codes were used in the crosswalks, the codes were adjusted to reflect the equivalent course code in the ACGM manual. Finally, it is important to remember that this analysis is limited by the number of crosswalks that were available for study. With only 12 colleges reporting crosswalks in their partnership agreements and more limited crosswalk reporting available from 38 college survey respondents, the results cannot be seen as a full reflection of crosswalk activities in the state. For this reason, the number of course crosswalks counted for each unique linkage is not included.

Highlights from the English Crosswalk Analysis

For students who graduated from Texas public high schools between 2004 and 2007, English IV is the most frequently reported high school dual credit course. Enrollments grew from 10,023 for 2004 high school graduates to 13,717 for 2007 graduates with almost 20 percent of all dual credit enrollments for 2004-2007 graduates reported for this one course alone (see Table A3 in the appendix).

As shown in the English crosswalk analysis (Table 4.4), English IV was most frequently crosswalked with English Composition I and II (ENGL 1301 and 1302 in the ACGM). However, English IV was also linked to English Composition I (1301) and British Literature (ENGL 2322), World Literature I and II (ENGL 2332, ENGL2333), British Literature I (ENGL 2322) and American Literature I (ENGL 2328), British Literature I and II (ENGL 2322 and 2323), and Forms of Literature (ENGL2341) and British Literature I (ENGL2322).

One measure that influences how course crosswalks are determined is the availability and sequencing of courses in a discipline (both in high school and college). For example, in the crosswalk analysis, the only courses that are ever linked with English III (Junior English) are college English Composition I and II. Course frequencies for 2004-2007 graduates show that 6,075 students in the cohort took English III for dual

Table 4.4 English Course Crosswalks Reported to THECB (Dual Credit Agreements and Survey)

High School Course*

03220400	ENGLISH IV
Count	46,331
A3220200	AP ENGLISH LIT AND COMP
	14,554
A3220100	AP ENGLISH LANG AND COMP
	7,313
03220300	ENGLISH III
	6,075
03241400	COMMUNICATION APPS
	1,584
03221600	HUMANITIES
	944
03221800	INDEP STUDY/ENGLISH
	691
03241300	SPEECH COMMUNICATIONS
	467
03221100	RESEARCH/TECH WRITING
	331
03221200	CREATIVE/IMAG WRITING
	259
03221500	LITERARY GENRES
	203
03240900	PUBLIC SPEAKING I
	196

College Course(s)

English Comp I (ENG 1301) & English Comp II (ENG 1302)
World Lit (ENG 2332) & World Lit (ENG 2333)
English Comp 1 (ENG 1301) and British Literature I (ENG 2322)
English Comp 1 (ENG 1301) and British Lit II (English 2323)
English Comp II (ENG 1302)
Forms of Lit (ENG 2341) British Lit (2321)
British Lit I (ENG 2322) and British Lit II (ENG2323)
British Lit (2322) and American Lit I (2328)
British Lit I (ENG 2322)
British Lit II (ENG 2323)
American Lit (ENG 2328)
Humanities (HUM 1301) Humanities II (HUM 1302)
Public Speaking (SPCH 1315)
Interpersonal Communication (SPCH 1318)
Intro to Communications (ENG 1311)
Intro to World Literature (ENG 2331)
Business and Prof. Commun. (SPCH 1321)
Creative Writing I (ENG 2307)
Creative Writing II (ENG 2308)

*Each HS Course Followed by 2004 to 2007 Cohort Count) credit. In districts that offer the option of taking a dual credit course for English III credit, it is unlikely that English IV will be linked with the same college courses as English III. A district may give students the option of taking English III or English IV for dual credit and link both courses with English Composition I and II (this example was cited by a dual credit coordinator in an interview). However, more commonly, schools that offer English III for dual credit link English IV with college literature courses.

After English IV, the next most frequent high school English courses reported with dual credit flags were AP English Literature and Composition, and AP English Language and Composition. Because of the unique issues related to AP and Dual Credit reporting issues, a discussion about AP/Dual Credit course crosswalks as a whole follows these subject-specific results.

Speech courses are a good example of linkages that vary by course title, but tend to stay within the boundaries of a subject or discipline. For example, Communication Applications and Speech Communication offered at the high school level (each ½ unit courses) were linked with four speech-related courses at the college level: Public Speaking (SPCH 1315), Interpersonal Communication (SPCH 1318), Intro to Communications (SPCH 1311) and Business and Professional Communications (SPCH 1321). These links may reflect local content, local preferences, or course availability.

Highlights from the Mathematics Crosswalk Analysis

There were over 21,890 dual credit enrollments recorded for high school math courses for the 2004- 2007 public high school graduation cohort (this includes only math courses with 150 individual enrollments or more during the four-year period studied).

Table 4.5

Mathematics Course Crosswalks Reported to THECB (Dual Credit Agreements and Survey)

High School Course*

03101100 PRECALCULUS
10,625
A3100101 AP CALCULUS AB
4,024
03102500 INDEP STUDY IN MATH (1ST TIME)
3,317
A3100102 AP CALCULUS BC
1,331
03100600 ALGEBRA II
812
03102501 INDEP STUDY IN MATH (2ND TIME)
(See arrows for INDEP STUDY IN MATH 1ST TIME)
770
A3100200 AP STATISTICS
568
03100500 ALGEBRA I
443

*Each HS Course Followed by 2004 to 2007 Cohort Count

College Course(s)

College Algebra (MATH1314) Trig. (MATH1316)
College Algebra (MATH1314)
Calculus I (MATH 2413) Calculus II (MATH 2414)
College Algebra (MATH 1314) Precalc. (MATH 2412)
Trigonometry (MATH 1316) Precalc. (MATH 2412)
Trigonometry (MATH 1316)
Statistics (Math 1342)
Finite Mathematics (MATH 1324)
Calculus I (MATH 2413)
Business Calculus (MATH 1325)
Linear Algebra (MATH 2318)
Differential Equations (MATH 2320)

Precalculus enrollments were, by far, the most frequent with a total of 10,625 students enrolled (see Table 4.5 on previous page). High school precalculus was most often linked with college-level Trigonometry (MATH 1316) and Precalculus (MATH 2412). However, high school precalculus was also linked with College Algebra (Math 1314) and Trigonometry I (MATH 1316), College Algebra (MATH 1314) and Precalculus (MATH 2412), and even with Calculus I (although this is just a one semester course).

A major alignment consideration in the math area is the reporting of calculus courses. The TEA PEIMS system does not provide a code for high school-level calculus. Perhaps the rationale is that calculus is a college-level course, by definition. Therefore, the only logical options for reporting dual credit college calculus courses through PEIMS are using AP Calculus course codes (for Advanced Placement AB and BC Calculus) or coding the course as Independent Study Mathematics. In the crosswalk study, Independent Study Mathematics was frequently linked to college math courses—but the courses varied considerably and included College Calculus I as just one of many possible links. Two of the dual credit coordinators interviewed mentioned that college calculus was linked with high school independent study math at their institutions; others said that AP calculus codes were used. The AP link is more commonly seen in the crosswalks. This makes a strong case for the availability of appropriate PEIMS course equivalencies for commonly taken dual credit courses.

Highlights from the Social Studies Crosswalk Analysis

Course frequencies for the 2004-2007 graduation cohort indicated that social studies is the most popular high school discipline for dual credit participation (Table 4.6).

Table 4.6 **Social Studies Course Crosswalks Reported to THECB (Dual Credit Agreements and Survey)**

High School Course		College Course(s)
03330100	UNITED STATES GOVERNMENT	American Government I (GOVT 2301) (Fed and State)
Count	27,691	American Government II (GOVT 2302) (Fed and State)
03310300	ECONOMICS W/EMPH FREE ENTERPR	American Government I (GOVT 2301) and II (GOVT 2302)
	18,807	Federal Government (GOVT 2305)
03340100	US HISTORY SINCE RECONSTRUCTION	US History I (HIST 1301) and US History II (HIST 1302)
	15,103	Texas Government (GOVT 2306)
A3340100	AP UNITED STATES HISTORY	Introduction to Economics - Consumer (ECON 1301)
	11,532	
A3330100	AP US GOVERNMENT AND POLITICS	Federal Govt (GOVT 2305) Texas Govt (GOVT 2306)
	6,777	
03350100	PSYCHOLOGY	General Psychology (PSYCH 2301)
	3,461	Lifespan Growth and Development (PSYC 2314)
03370100	SOCIOLOGY	Intro to Sociology (SOCI 1301)
	1,965	
A3310200	AP MACROECON	Principles of Macroeconomics (ECON 2301)
	1,877	
A3310100	AP MICROECON	Principles of Microeconomics (ECON 2302)
	1,375	
03380001	SOCIAL STUDIES ADV (1ST TIME)	Intro Philosophy (PHIL 1301 PHIL 1304 PHIL 2306)
	877	Intro to World Religions (PHIL 1304)
A3350100	AP PSYCHOLOGY	Introduction to Ethics (PHIL 2306)
	816	Cultural Anthropology (ANTH 2351)
03380002	SPEC TOPIC IN SOC STUD (1ST)	
	582	
A3330200	AP COMPARAT GOV & POL	
	314	

*Each HS Course Followed by 2004 to 2007 Cohort Count

There were two one-semester (1/2 unit) social studies courses required for a high school diploma: US Government and Economics with Emphasis on the Free Enterprise System. These courses are often taken by high school juniors and seniors and they are the two most popular dual credit options in the social studies field. Since only one college semester course is generally linked to each of these courses, students usually complete one semester of college coursework to receive credit for these courses. However, this is not always the case.

Although US Government was most frequently linked with American Government I in the crosswalks studied, it was also linked with both American Government I and II by several schools. A crosswalk linking two college courses to a ½ unit high school course appears to be misreporting, based on TEA guidelines, but this practice was confirmed by a high school-level dual credit coordinator in the interview phase of the study. The coordinator noted that her district had decided that both college government courses are necessary to fully cover the TEKS for the one-semester high school US Government course. In this case, the district justified deviating from the guidelines to achieve a crosswalk they believed to be more accurate. However, this raises issues about equity if most districts in the state do not require the additional college course.

Another social studies course that does not align well with lower-level college course offerings is the required high school history course, US History since Reconstruction. This full year US History course covers only post-Civil war history. Pre-Reconstruction US History is covered in grade 8 in the state TEKS curriculum. Most school partners choose to link two college-level US History survey courses, US History I (American History until 1865) and US History II (Post-Civil War American History), to the high school course. But a significant number of schools choose to link the college United States history sequence to an AP course code, AP United States History, a course which covers a fuller spectrum of US History.

Perhaps the most straightforward links found in the crosswalk study were the links for psychology and sociology courses. Every time high school psychology (03350100) was reported in the crosswalk analysis it was linked with PSYC 2301, General Psychology, at the college level. Similarly, the high school sociology course (03370100) was always linked with Introduction to Sociology (SOCI 1301), a lower-division sociology offering. When AP psychology was reported on the high school side, it was also linked with the General Psychology course.

Differences in the structure and specificity of high school and college departments were evident throughout the crosswalks but perhaps most evident in the social studies crosswalks. Students taking college courses in, for example, government, history, economics, sociology, psychology, anthropology and philosophy all receive social studies credits for high school for these courses. Therefore, college faculty from a number of departments may be involved in working with high school social studies departments to coordinate dual credit offerings. The "Social Studies Advanced " (03380001) and "Special Topics in Social Studies" (03380002) course codes are frequently used to link high school and college social studies courses, probably to account for the broad spectrum of college offerings in social-studies related disciplines which do not readily align with traditional high school courses in the field. Based on a review of the TEKS for these two courses, the social studies advanced course seems a less suitable link because it stresses independent study projects rather than traditional classroom work while the TEKS for special topics indicate that students are "provided the opportunity to apply the knowledge and skills of the social sciences to a variety of topics and issues" (TAC, Chapter 19 § 113.38).

Highlights from the Science Crosswalk Analysis

Based on the dual credit frequencies found for the 2004-2007 graduation cohort, of the four foundation subjects studied in the crosswalk analysis, high school science courses were the least frequently reported with dual credit flags. In addition, high school science courses were some of the most likely courses to be reported with AP course codes. High school AP Biology linked with college General Biology (BIOL 1406 and 1407) was the most commonly reported of the science links.

High school biology is a good example to use in understanding the difficulties that can arise in making crosswalk determinations between the secondary and post-secondary sectors. Because most high school students are required to take biology in the freshman or sophomore year, and dual credit is not an option for students until the junior and senior year (except at early college high schools and in other special circumstances) it is unlikely that a student signing up to take a college biology course would not have already completed the high school biology requirement. This is logical given that the college biology requirement is built on the expectation that students have completed high school biology. Therefore, high schools have a difficult decision to make when

Table 4.7.

Science Course Crosswalks Reported to THECB (Dual Credit Agreements and Survey)

High School Course*		College Course(s)
A3010200	AP BIOLOGY	Gen. Biology I and II (BIOL 1406, BIOL 1407)
Count	3,979	Biology for Non Science Majors I and II (1408, 1409)
A3040000	AP CHEMISTRY	Gen. Chemistry I (CHEM 1411) and Gen. Chemistry II (CHEM 1412)
	632	
03040000	CHEMISTRY	
	575	Introductory Chemistry I and II (CHEM 1305, 1105 ; CHEM 1307,1107)
03010200	BIOLOGY	
	564	
03050000	PHYSICS	College Physics I and II (PHYS 1401, PHYS 1402)
	492	
03060201	INT. PHYSICS/CHEMISTRY	Anatomy and Physiology I and II (BIOL 2401, BIOL 2402)
	335	
A3050001	AP PHYSICS B	
	208	

*Each HS Course Followed by 2004 to 2007 Cohort Count determining crosswalks for college biology: do they report the course with a dual credit flag under a course code used previously (high school biology) or do they report the course as AP Biology, even if the course is not an official AP/dual credit overlay course? One high school dual credit coordinator interviewed confirmed with her reporting staff that the high school biology course was reported under the high school biology code, even for students who already received credit for the high-school course in a previous year. Therefore, that student's TEA record included the same course twice for credit. Other coordinators reported the use of the AP code, even if the course was clearly not AP.

The same situation applies to Chemistry and Physics. If a student has not completed the high school level course, coordinators must decide if it is appropriate for the student to take the introductory college course. If the student has already completed high school-level Chemistry or Physics and wishes to take the first college-level course, the school must decide how to crosswalk the course. Different crosswalks might have to be used, depending on what high school courses have been completed. Or AP Chemistry or Physics codes could be used, even if the course is not a college board advanced placement course.

In investigating this issue, the researcher learned that TEA science curriculum staff now advise high schools and colleges to use a course called "Scientific Research and Design" listed under Health and Science Technology Education Courses in the TEKS (TAC Chapter 19, §112.71) for students who take Biology, Chemistry, or Physics as a dual credit course. This research course alternative has broad content guidelines, and counts toward the four-by-four curriculum mandated by the Texas Legislature for students entering high school in 2007-2008 and later. However, some schools appear to resist these types of "independent study" designations when crosswalking courses. School districts may not award these courses extra weight in a student's GPA, and some schools prefer to link college courses to required high school courses (courses for which an independent study alternative cannot be substituted to meet graduation requirements).

The frequency analysis of dual credit courses taken (see table A2) shows only 195 2004-2007 high school graduates took "Scientific Research and Design" for dual credit while in high school, a number that was far below the frequencies for biology, chemistry and physics alternatives. However, the number of students enrolled in Research and Design jumped from 23 in 2006 to 96 in 2007. This suggests that schools are beginning to view this code as a viable option for reporting dual credit science courses.

The longitudinal data in the dual credit frequency table indicates a change in reporting for another high school science course: Integrated Physics and Chemistry. This course, which is offered to high school students as an alternative to the Chemistry and Physics sequence, was flagged as dual credit 335 times in PEIMS during the study period. However, the reports went from 132 students in 2006 to 2 students in 2007. Since Texas colleges do not offer a course that integrates these two subjects, and no crosswalks were recorded for this course in the crosswalk analysis, the reduction in frequency may reflect better understanding on the part of school personnel about what constitutes a dual credit course. Note that this example is similar to the Algebra I example presented in the mathematics section.

AP/IB Courses and Course Crosswalks

PEIMS system data for students in the 2004-2007 graduation cohort showed that almost 24 percent of the dual credit courses flagged (58,026 of 242,253 courses) were reported with AP or IB course codes (see Table A4 in the Appendix). The crosswalk study supported the notion that dual credit courses are deliberately reported with AP course codes. As can be seen in the crosswalks in Tables 4.4 through 4.7, AP courses are among the most common high school courses linked with college courses. Given that AP courses are designed to be college-level options for high school students, the linking of AP PEIMS codes with dual credit courses makes sense from the standpoint of content similarity.

In the initial development phase for this research, early data explorations of PEIMS course completion records showing high levels of AP courses flagged as dual credit caused concern that districts might be inadvertently reporting AP courses as dual credit when no link existed. Speculation that schools misunderstood the difference between a dual credit course and an AP course led to this conclusion, despite longstanding PEIMS data standards instructions stating: "AP courses taken at the high school are not to be reported as dual credit" (TEA, 2007 data standards). The research done for this study, including the results of the course crosswalk analysis, suggests that it is a much more prevalent practice for schools to report dual credit courses with AP course codes than for them to misreport AP courses with dual credit flags. In other words, most of the AP codes flagged as dual credit in the PEIMS system appear to be dual credit courses. The major question that remains is: how many of these courses are truly AP/Dual credit overlay courses and how many are simply dual credit courses reported with AP codes?

Support for the conclusion that AP courses are not being misreported as dual credit in high numbers comes from several sources. The matrix presented in Table 4.1 shows dual credit and related enrollment records for the 2006-2007 academic year. The 15,846 students who were shown as enrolled in dual credit courses in PEIMS, but not enrolled in a public college during the same period, took approximately 20,000 courses which were flagged as dual credit. Only about 10 percent of those courses had AP course codes. This does not suggest excessive misreporting of stand-alone AP courses as dual credit. However, since course data cannot be matched across systems, it is possible that AP misreporting is more prevalent than this comparison suggests. It may be masked by a high number high school students who took both AP courses and dual credit courses during the same period.

Interview results confirmed the practice of reporting dual credit courses with AP codes but did not confirm the possibility of AP courses being mistakenly reported with dual credit flags. Many of the dual credit coordinators interviewed stated that AP course codes are used to report dual credit courses. Some reported this practice linked to AP/dual credit overlay classes, while others said the AP codes are used even if the course is dual credit alone. While several coordinators mentioned that the practice of linking AP codes to dual credit courses is becoming less common in their districts, and two of three who mentioned dual credit/AP overlay options noted a decrease in this practice, the trend data for the 2004-2007 graduation cohort show a steady increase in the number of AP course codes with dual credit flags. However, the percentage of AP course codes as a percent of the total courses taken has dropped slightly (see Table A2).

As a result of the new AP audit program sponsored by the College Board, some of the experts interviewed foresee a change in dual credit/AP reporting. This is discussed in more detail in the interview section.

Dual Credit Crosswalk Variability

Evidence of the variability in high school to college course linkages is seen in the dual credit crosswalk analysis. The variability is greater for some courses and subject areas than for others. Because information about course crosswalks was only available from 48 institutions, and some of the crosswalks reported by colleges were limited (crosswalks were not provided for all partner high schools), the crosswalk analysis is limited and may not fully represent the use of crosswalks to link high school and college dual credit offerings. In the dual credit agreement review and interview results sections that follow, information gleaned from the dual credit partnership agreements and the interview process provides additional insight into how crosswalks are perceived and constructed by partner institutions. These additional sources support the crosswalk analysis finding that dual credit crosswalks differ not only across school districts and college service areas, but also within them.

Dual Credit Agreement Review

Background

Texas Higher Education Coordinating Board Rules, (Chapter 4, Subchapter D, §4.84), require that, "For any dual credit partnership between a secondary school and a public college, an agreement must be approved by the governing boards or designated authorities (e.g. principal and chief academic officer) of both the public school district or private secondary school and the public college prior to the offering of such courses" (THECB, 2009). The rules specify the "The dual credit partnership must address the following elements: (1) Eligible Courses; (2) Student Eligibility; (3) Location of Class; (4) Student Composition of Class; (5) Faculty Selection, Supervision, and Evaluation; (6) Course Curriculum, Instruction, and Grading; (7) Academic Policies and Student Support Services; (8) Transcripting of Credit; and (9) Funding" (THECB, 2008).

A request for copies of dual credit agreements was sent by the THECB Assistant Commissioner for Planning and Accountability to all public colleges and universities in Texas on July 9, 2008. The purpose of the request was to compile a database of agreements for reference and research activities. With the growth of dual credit programs around the state, interest in understanding dual credit programs has increased as has interest in the construction and contents of the agreements that create them. The researcher was provided access to these agreements for the purpose of conducting an analysis for this study. Some colleges submitted a copy of each agreement enacted by their institution with local public and private high schools; others provided a template agreement (allowed in instances where individual agreements were substantively the same). Each of the agreements received was reviewed and information pertaining to the research questions in this study was extracted and analyzed. The relevant findings are presented next.

Overview of Agreements Submitted

A large majority of Texas public higher education institutions responded to the request for dual credit agreements and a subsequent follow-up request sent a few months later. Overall, 88 institutions responded: 71 institutions submitted agreements and 17 reported no dual credit programs on their campuses. Fewer than ten institutions failed to submit information. While the majority of the agreements came from two-year colleges, 14 universities submitted documentation. The count includes both systems and individual community colleges, depending on which entities supplied the materials. The community colleges that did not respond were generally small, stand-alone institutions.

Institutions that responded to the request for agreements but did not provide agreements from each partner were asked to list the high schools or school districts with which they partner. Overall, 42 institutions provided either copies of all agreements or a list of current partners. From these 42 institutions, 754 institutional partnership agreements were provided or identified for an average of over 17 agreements for each college or university. Some of these agreements were with school districts, but more commonly the agreements were with specific high schools. Based on the agreements received, four-year institutions generally have fewer dual credit partners than two-year institutions. As noted earlier, agreements with both public and private high schools were common.

As was expected, most of the institutions addressed the nine elements required for partnership agreements by THECB rule. The level of detail in the agreements varied considerably from higher education institution to higher education institution, but significantly less within each college service area, with most institutions using a similar template for every high school partner. In many instances, language from the THECB rules was included verbatim or in paraphrased form. While agreements were dated as recently as the semester of this writing, there were also agreements dated as far back as 2002. By design, some agreements included information that requires semester or yearly updates, for example, course lists with instructor assignments, class locations, assigned instructors, and remuneration details. Others agreements included more general information.

Student Eligibility Requirements

The student populations who enroll in dual credit courses are, to a significant extent, determined by THECB eligibility rules. Dual credit students in Texas public colleges must meet eligibility requirements of the Texas Success Initiative and/or dual credit rules, which have comparable requirements for enrollment in college-level courses. Higher education institutions and their secondary school counterparts are permitted to mandate additional eligibility requirements for dual credit participation. Approximately 20 percent of the agreements reviewed specified additional requirements for dual credit enrollment. The most common included having a top 25 percent high school class rank, maintaining a grade-point average of at least a B (or a 3.0 or 80-88, depending on the agreement), and having a C or better average in previous college courses attempted. Several agreements mentioned a requirement that students follow all regular admission procedures for college enrollments and a few noted that all regular college course prerequisites had to be met. Certain types of dual credit-based programs, such as early college high schools or special academies, had additional requirements for admission. In these cases, ability to enroll in the programs and the affiliated dual credit courses depended on the results of a selective admissions process or meeting special enrollment qualifications. Generally, these processes were mentioned but specifics were not included in the dual credit agreements. Colleges and universities with early college high schools generally enact specific agreements that pertain only to the early college program.

Dual Credit Course Location

As required by the dual credit rules, most agreements included information about course location. While most colleges indicated that courses are available on both the high school and college campus, several four-year institutions offered college-campus options only. The fall 2007 THECB dual credit survey results indicated that approximately 80 percent of Texas high school students enrolled in dual credit courses on a high school campus and the remaining 20 percent attended classes held on a college campus (THECB, 2007b). However, because high school dual credit courses often include high-school-level students only (at least those held during the school day) and college dual credit opportunities almost always include high school and college-aged students (with the possible exception of some early college high school classes), it is not surprising that approximately one-half of the college courses with enrolled dual credit students were held on college campuses and one-half were held at participating high schools.

Distance education or ITV (Interactive Videoconferencing) broadcasts were also mentioned in agreements, often with specific requirements for ensuring that classes with off-site instructors were appropriately monitored. To provide an example of variations for course location, one college system submitted a dual credit agreement template which included a check list of possible course location options including a restricted course on the high school campus (for students enrolled in that high school only), an open enrollment class on the high school campus, an extension center based on the high school campus, and a class on the college campus.

Most dual credit partnership agreements include language that provides insight into how crosswalks are determined. Course and instructor rigor and quality are also frequently alluded to in agreement verbiage, with emphasis on maintaining standards across secondary and postsecondary levels and ensuring high school students receive the same level of content instruction and rigor in assignments and grades as all other students of the college. The next two sections will address these issues in greater detail.

Determining Course Crosswalks

Understanding how course crosswalks are determined is an important element of understanding dual credit coursetaking data. Language regarding how the Texas Essential Knowledge and Skills (TEKS) curriculum will be addressed by dual credit partners is frequently included in dual credit agreements, with several variations in approach. Many agreements cite verbiage from two TEA sources. The language in the TEKS curriculum that allows for credit to be awarded for courses taken at a college, says the college course must "meet or exceed" the TEKS for the linked high school course (see, for example, TAC, Title 19, Part II, § 110.88); another place in TEA Rules (TAC, Chapter 74 Subchapter C, §74.25(b)) calls for instruction in the college-level course that is "beyond or in greater depth" than the high school TEKS requirements.

Dual credit courses are college-level courses for which a high school student receives high school credit for an equivalent course, not high school courses to which college material has been added. Thus, the administration and monitoring of the courses is generally considered to be the responsibility of the higher education institution. However, when it comes to determining crosswalks, high schools are generally thought to be the primary players because the high school equivalent course must be determined. While TEA does provide the aforementioned general guidelines for linking college and high school courses, institutions clearly have a great deal of latitude in determining how to best approach the alignment process.

While all of the agreements reviewed that mentioned crosswalks directly expressed or implied that the high school is an important player in the crosswalk process, some of the agreements put the onus completely on the high school for determining crosswalks and verifying compliance with the TEKS. Several of the agreements referred to the importance of meeting TEA "requirements" for course alignment without further specificity. In others, a staff position or positions were mentioned to indicate the person responsible for course alignment (for example, the chief curriculum officer at the school district). Sometimes agreements included formal, legal language about the TEKS alignment process. For example, one stated that the appointed school had "analyzed," or "reviewed" the TEKS and "certified" that requirements had been met, and another noted that the partner college was "mandated" to meet TEA curriculum expectations.

Frequently dual credit agreements mentioned college course syllabi in relation to course crosswalks. For example, an agreement noted that the college partner agreed to provide the syllabus or a course description to the high school well in advance of the course start date for TEKS review and alignment purposes. Since many agreements reported established linkages between high school and college courses, it is likely that, for most institutions, the alignment process occurred once or at spaced intervals, rather than every semester or for every course offered. With established linkages, students know well in advance which high school course credits are available for specific college course offerings and can plan schedule accordingly.

A number of the agreements reviewed suggested a collaborative approach to determining course crosswalks. A few even included language extolling the multiple benefits of bringing high school and college faculty together for this purpose. One agreement called on “discipline teams” to make alignment determinations, with methods determined by “mutual agreement.”

There were agreements submitted that proposed that TEKS alignment need not be limited strictly to a review of college coursework and determination that the college course meets TEA requirements for TEKS. For example, one agreement noted that reinforcement of TEKS is the responsibility of the school district, and indicated that additional instructional materials may be added to a course. Another agreement suggested that when a college instructor is provided for a course, he or she may be responsible for incorporating high school course curriculum. In one agreement, the effort of correlating the college course with the TEKS was referred to in a way that suggested the college syllabus may be altered. Another agreement bluntly stated that the instructor is not responsible for teaching the TEKS.

The 2007 dual credit manual from a large suburban system reflects perhaps the most explicit language about determining crosswalks reviewed for this study. Crosswalk agreements did not provide this level of detail:

> "College and ISD representatives with content expertise must agree on the appropriateness of topics and outcomes, methods of evaluating student work and course activities. This may occur through means as simple as a review and validation of the TEKS of the course at the secondary level with the course topics and outcomes at the post-secondary level or as complex as a rewrite of the secondary-level course to add the components that might be necessary to fulfill college requirements. The Dual Credit Outcomes Matrix should be used to match outcomes for all workforce/technical (WECM) courses. Syllabi for high school courses should be kept as records of outcomes matches for all academic (ACGM) courses." (*citation withheld)*

As mentioned in the crosswalk analysis, course crosswalks vary considerably across institutions. The agreement review revealed that the process for determining high school and college course crosswalks and integrating high school curriculum into college syllabi also varies across institutions. The interview portion of the study revealed additional information about how crosswalks are developed. While some colleges are very involved in the process, others do not have any knowledge of which high school courses are linked to the dual credit courses they provide.

Rigor and Quality in Dual Credit Agreements

Most of the dual credit agreements reviewed contained information about course and instructor quality and course rigor: areas that relate to program alignment across educational systems. THECB rules for dual credit agreements specify that faculty selection, supervision, and evaluation be addressed along with course instruction and grading. The rules also require that institutions "ensure that a dual credit course and the corresponding course offered at the main campus of the college are equivalent with respect to the curriculum, materials, instruction, and method/rigor of student evaluation" (TAC Chapter 4, Subchapter D, 4.85(f)). Although the rules do not stipulate how this equivalency is to be achieved, the agreements frequently provide policies or recommendations for practice. Several common approaches emerged when reviewing the agreements; many focused primarily on ensuring the courses taught on the high school campus match the rigor of the college-based courses and programs.

Instructor Qualifications

Almost every dual credit agreement addresses faculty qualifications. In addition to the required qualifications detailed in the THECB rules that call for dual credit instructors to meet standards for college hiring set by regional accrediting agencies, many colleges consider dual credit instructors adjunct faculty, with all of the rights and responsibilities of that status. Some colleges require dual credit instructors to go through the same hiring process of other adjuncts while others simply request documentation of qualifications. Many institutions note that evaluation policies for faculty are the same for all adjuncts, dual credit instructors included. A few agreements state that high school dual credit instructors are not college employees. The high level of detail in the agreements regarding instructor status probably speaks to the potential for confusion about responsibilities in instances where the lines of authority are blurred (more specifically, when faculty are responsible to both the high school and college). Funding arrangements regarding the payment of faculty are often quite explicit in dual credit agreements. Some high school teachers who instruct dual credit courses are paid the traditional adjunct rate, some are paid by the high school which receives a lump sum from the college for each instructor, and at times no money changes hands. It was difficult to determine how closely the status of the instructor was tied to the college's dual credit faculty compensation policy.

In a few instances, dual credit agreements included the requirement that college staff observe or monitor high school dual credit classrooms on a regular basis. More agreements recommended such observations but without a schedule specified, and several mentioned required observations for first time instructors. One agreement included the caveat that college staff would be admitted into school district high schools to conduct observations without providing advanced notice to high school personnel. This caveat hints at past problems with defining the rights and responsibilities of the college and high school partners.

Several of the dual credit agreements reviewed included required professional development for dual credit instructors; some agreements recommended that high school instructors attend or teach an equivalent course on the college campus. One agreement clearly stated that, whenever possible, dual credit instructors were expected to teach courses on the college campus.

Classroom Rigor and Grading Policies

In several instances, dual credit agreements required instructors to submit major tests and assignments, including examples of graded student work, to college department supervisory staff. This allows for both review of instructor materials and monitoring of student progress and grading standards. One agreement asserted that all of the parties involved in the dual credit program understand that course policies and practice are under college jurisdiction. Potential conflicts could arise if high school personnel had jurisdiction over grades or classroom activities.

Language about alignment of grades for high school and college courses was included in several agreements. Most indicated that grading was done on a college scale and that high schools were responsible for adjusting the college grades to fit the high school reporting schema (letter grades to numeric grades, etc.). Some agreements included details about when and how weighted grade points were determined. This detail was often linked to course crosswalks: for example, when college-level courses are equated with honors-level high school courses, extra grade points were awarded. One agreement specified that students could take dual credit courses pass/fail and explained how student GPAs would be adjusted. Finally, a few agreements (and some of the dual credit coordinators interviewed) stressed that UIL (University Interscholastic League) requirements for periodic grade reports to establish eligibility for participation in extracurricular activities would not or might not (depending on the college and situation) be met by the colleges. Under UIL rules, students may only participate in UIL events if they are passing all classes. If a dual credit instructor or college does not provide grade reports at appropriate intervals, this can interfere with establishing eligibility. One online dual credit document reviewed specifically stated that students taking dual credit courses would not qualify for UIL competitions.

While most agreements included language that indicated high school students were graded on the same scale with the same level of rigor as college students, a few of the agreements noted that instructors can give different grades for high school and college-level credit. One agreement cited a now defunct section of THECB rules allowing for differentiation in grading for dual credit courses with students taking the course for college or high school credit. This does not mesh with current THECB rules that state that, except for a few exceptional circumstances, students should not be in a dual credit course if they are taking the course for high school credit only (AP students are an exception to this rule). A website for another college included a conversion table for college and high school dual credit grades, with a D in college equating to a low C in the high school course.

Student Maturity and Dual Credit Courses

Student maturity was a common theme in several dual credit agreements as was student readiness to complete college-level material in a college environment. Several agreements also mentioned the need for students and parents to be aware that college courses are designed for adults; high school students might be exposed to controversial materials or discussion topics in a dual credit setting. This kind of language was frequently seen in the student/parent contracts submitted with some college's dual credit agreements.

Summary of Dual Credit Agreement Analysis Results

Information gleaned from Texas public college and high school dual credit partnership agreements was generally in line with dual credit rules and stated requirements. Much more diversity was seen in areas that were not regulated by rule or law. Also, some requirements were, in general, interpreted more loosely than others.

Similarly, requirements were interpreted loosely by some institutions, but were interpreted more rigorously by others. For example many agreements expanded upon the requirement that students "shall not be enrolled in more than two dual credit courses per semester" unless special permission is granted. Some had very stringent rules for allowing students to take additional courses and others seemed much more lax about this restriction. All of the agreements received were very clear about educational requirements for instructors. This may be related to accrediting body requirements for adjunct faculty.

Overall, dual credit agreements provide insight into rule interpretation and partnership-level policies at Texas public schools and colleges. They also capture some of the practices that make each program unique. Those practices were very much a focus of the interview portion of the research study which is discussed next.

Interviews with Dual Credit Coordinators

This study was designed with an interview component to ensure that interpretations of dual credit data and documents align with practices and perceptions in the field. Two pilot interviews were conducted in July and August of 2009. The format of the interviews generally worked well; however, the researcher determined that it was better to ask the prepared interview questions in an order that fit the flow of the discussion rather than in the order listed (see A1 in the appendix for interview questions).

An additional nine interviews were conducted with high school and college dual credit coordinators/administrators between September and November 2008. The interviews were paired so that a high school and a college coordinator in the same college district were interviewed (at separate times). This provided an opportunity to compare high school and college coordinator perspectives on programs that were common to both parties. A final, twelfth, interview was conducted in January 2009 with a state level expert on dual credit programs.

Six of the interviews were held with college dual credit coordinators, one of which was conducted as a conference call with a district-level and a campus-level coordinator from the same community college system. Three additional interviews were held with community college coordinators. A college-based Early College High School coordinator and a four-year university administrator with responsibilities for dual credit programs also participated. The colleges these individuals represented included rural, suburban, and urban campuses located in Northwest, Central, Eastern and Southern Texas. Most of the interviewees were identified through professional connections. The researcher was acquainted with one of the participants prior to the interview.

An additional five interviews were conducted with high school dual credit coordinators. The high school coordinators were identified by recommendations from the college coordinators interviewed. Four represented public high schools, including rural and suburban/urban schools and one was a private high school counselor from a parochial school that partnered with a public institution of higher education.

The interview results provide an alternate window for considering dual credit programs and data. Understanding how school personnel understand and approach dual credit issues provides helpful context for the study of dual credit coursework patterns, data alignment, and student populations. This section highlights what was learned about these topics through the interview process, along with some additional findings that are of interest.

Determining Dual Credit Crosswalks

The dual credit coordinator interviews raised several issues related to course crosswalks. The verbiage in many dual credit agreements suggested that for some high school college partners, course crosswalk decisions were left entirely up to the high school. This finding was supported by the interviewees. A few of the college coordinators said that their college had no involvement with determining which high school courses were linked to college courses. All of the coordinators interviewed either stated or implied that awarding high school credit is ultimately a secondary school-level decision. One coordinator shared a belief that, for many high schools in the region, the crosswalks were determined several years ago and had not been revisited since. In her opinion, tradition was the major determining factor in what courses were linked. Not surprisingly, no college reported consistent crosswalks with every high school partner.

When asked about curriculum alignment, some coordinators mentioned a curriculum alignment process that involved both the high school and college partners. At a high school in a rural region that was new to dual credit programming, the high school counselor worked closely with the college dual credit coordinator to determine the crosswalks. Another coordinator mentioned that staff from related disciplines worked together to review the college course syllabus and the TEKS and match learning objectives.

A suburban high school coordinator noted that in her district the curriculum department made the decision about TEKS alignment for dual credit courses. This matched with a comment from the coordinator from the high school's partner college who said that, in her opinion, high school curriculum staff members are much more concerned with matching state curriculum standards to college curriculum than high school administrative staff. Another alignment issue raised by one college coordinator was the emphasis some high schools place on ensuring that TEKS are covered when the linked high school course includes material tested on the high stakes exit-level TAKS assessments which students are required to pass for high school graduation. Clearly it is a priority that students perform well on these tests.

Many coordinators gave examples that suggested a lack of consistency in how high schools determine dual credit crosswalks. One noted that, in some instances, crosswalks varied not only by school, but also from student to student. An example given was a high school where the principal was known to decide dual credit on a case by case basis. Finding a link that matched the student's need for credit was the stated rationale. One high school coordinator interviewed said that at her district a student may apply to have any college-level course accepted for dual credit, whether the course was taken at the partner college or elsewhere. This would suggest that individual determination of course linkages does occur. While all coordinators noted a lack of consistency (some much more than others), there was disagreement about the need for more consistency. Several coordinators viewed flexibility in crosswalk determination as a positive circumstance; others voiced concern that more consistency is needed.

High school dual credit coordinators reported instances where high school and college credits were awarded in unusual ways. For example, one school allowed students to take two dual credit courses a semester. If students wished to attend an additional class offered on campus, they had to pay tuition, but they were welcome to attend as a concurrent enrollment student. Thus, in a single high school classroom, some high school students were receiving dual credit and others were receiving college credit only. In this case, the concurrent enrollment students were required to pay full tuition. A similar example was given by another coordinator who allowed a student to enroll in a dual credit course, even though the student had already received credit for the linked high school course. In this case, the student took the course to earn college credits at a reduced cost. In addition to classrooms with concurrent and dual credit high school students enrolled, there were also examples of classrooms in which students were taking the exact same college courses for different high school course credits. At one high school, juniors were taking English 1301 and English 1302 (composition I and II) for English III credit and seniors were taking the same course for English IV credit. As the course crosswalk analysis shows, English 1301 and 1302 are frequently linked with both English III and IV.

This example raises the issue of how schools determine appropriate course crosswalks. While some high school coordinators spoke of efforts to integrate the high school curriculum into the college course, others indicated that they look at the college syllabus and try to determine which high school course matches best; they do not attempt to alter or change the college course. Interestingly, one high school coordinator said he thought he could legitimately align almost any course from high school to college.

As also seen in the language in the dual credit agreements, the coordinators varied in terms of how they thought the college and high school curriculum should be linked. Some cited the “meet or exceed the TEKS” language from the state curriculum and others the “beyond and in greater depth” language that is found in TEA rules. One said that in his district an effort is made to ensure that all the TEKS are covered, but the expectation is that they will be covered in greater depth than in the high school course. If the college syllabus requires skills that are beyond the TEKS, and if the TEKS are required for mastery of those skills, the TEKS are considered to be covered. When told of a TEA document requiring that TEKS be “met” for all dual credit courses, one college coordinator said it would be impossible for all the TEKS for a high school subject to be incorporated into a college course. Other coordinators spoke of covering or meeting course TEKS as a matter of course.

The coordinators spoke candidly about several specific crosswalk issues, many of which are reported in the crosswalk analysis. The difficulty of creating appropriate crosswalks for math courses was raised by two of the high school coordinators. In one coordinator’s high school, college algebra is offered free of charge during the school day as a concurrent enrollment option. The school does not believe the course links to any TEKS-based high school course, but has deemed it an important course for college-bound students. Another coordinator mentioned that a special task force of college math teachers had looked carefully at the high school and college math sequence and had real difficulty aligning the requirements.

Two coordinators noted the possibility that the new state four-by-four curriculum requirements will lead to new opportunities for dual credit course options in science and math. Beginning with the 2007-2008 freshman high school class, students in Texas who choose to complete the recommended high school curriculum will have to complete four years of math, English, social studies, and science. The availability of dual credit opportunities in areas like physics makes it possible for students to take a course that the high school does not otherwise have the ability to offer. Dual credit options like anatomy and physiology and college statistics may also be of interest to students. Both a rural public high school coordinator and the private high school counselor interviewed mentioned that dual credit opportunities were the only means they had of providing physics courses for their students. And one coordinator noted seeing more "innovative" high school course codes linked with college courses for dual credit as more diverse college course options were being made available to students.

Program Alignment Issues

In one interview, an urban community college coordinator stated that the large districts in his region expected the college to cooperate with them on issues of alignment. Conversely, he noted that the smaller high school districts were more willing to cooperate with the community college. This tension regarding collaborative responsibilities is an indication of the difficulties in aligning programs across educational institutions, especially large ones that may have complex regulations and hierarchical structures.

A major alignment issue raised frequently in the coordinator conversations was class scheduling. Coordinators from both levels conveyed a number of different approaches to effectively integrating a college schedule into a high school schedule. For example, the private high school coordinator reported that her school had adopted a block schedule so that college courses held on the college campus could more easily be included during the class day.

Keeping track of student absences were of concern to many of the high school and college staff. They also reported problems with dual credit classes being interrupted for school programs such as pep rallies and benchmark testing. This is particularly a problem when college faculty members are sent to teach on a high school campus and only have two class meetings per week with their students. One high school reported creative scheduling for their economics and American government dual credit courses. High school students took economics on Monday and Wednesday and Government on Tuesday and Thursday for two periods each day to fit the traditional college schedule. The students were allowed early release on Friday.

Dual Credit Data and Reporting Issues

Several interview questions for the study participants related to the reporting of dual credit data. While many of the reporting practices were shared in the AP and PEIMS data section, additional information about reporting issues is presented below.

Concurrent Enrollment versus Dual Credit Reporting Issues

The dual credit coordinators interviewed presented very useful information about concurrent enrollment versus dual credit reporting practices. One interview participant said that at all dual credit summer enrollments at her institution are reported as regular enrollments, even if the students are taking a course for dual credit. A coordinator from a large community college campus reported that high school students enrolled at her institution are always reported as taking dual credit contact hours, even if those hours are for college credit only. Finally, a college coordinator with a large dual credit population stated that students in his district were reported to THECB with dual credit hours if they took a course on the high school campus but not if the course was taken on the college campus – those courses were reported as regular credit hours only.

Despite these discrepancies in reporting practices, the coordinators interviewed generally understood the distinction between dual credit and concurrent enrollment once the definitions used in this study were provided. But because the THECB definition of dual credit differs from the TEA definition, and because differentiating between dual credit and concurrent enrollment high school students is difficult for colleges, understanding the difference between dual credit and concurrent enrollment and reporting those differences correctly is not the same thing. Finally, not all of the college coordinators knew how dual credit and concurrent enrollment hours were reported for high school students on their campuses.

AP Reporting and Course Crosswalks

In the data analysis of 2006-2007 dual credit high school and college enrollments, a large percentage of the high school courses reported for dual credit were reported with AP course codes. The interview results found that some schools did use AP/dual credit designations for courses and combine students from both programs in one class. These students were reported with AP codes and dual credit flags. Many schools did not offer AP/dual credit overlay courses. One interviewee said AP codes were never used to report dual credit classes in her school district and another noted that the only AP code ever used for a non-AP dual credit course was the code for AP calculus. This coordinator cited a lack of other options for reporting this course as the reason the code was used. In one interview, the weighting of courses on the high school transcript was given as a primary reason for using AP course codes. A conflict in a district over who was going to be valedictorian based on how dual credit versus regular honors courses were weighted was provided as evidence for the pressure put on schools to find appropriate crosswalks for dual credit courses.

There is a lot of tension and competition between AP and Dual Credit programs on high school campuses, according to one of the interview participants, who added that some AP teachers do not have the credentials to teach dual credit. Information from a coordinator at a high school which generally offers dual credit courses taught by college faculty who are brought onto campus revealed that AP courses could not be instructed by these professors. The coordinator did add that when the district does have a high school teacher who is qualified to teach both dual credit and AP, they have arranged for the teacher to do so in a joint class. A coordinator from an institution in South Texas with a long-standing dual credit program said that the AP programs in her area lose too many students when the classes are not offered in conjunction with dual credit. She believes her population is better served by the possibility to earn simultaneous credit rather than rely on an AP test. She added that senior year AP score results arrive too late for many college admission decisions, whereas dual credit grades are available earlier. Thus, the reporting of AP codes with dual credit flags accurately reflect course enrollment practices in this region.

The state-level dual credit expert interviewed for this study, along with two of the high school coordinators, noted that AP course audits – which were required by the College Board for all AP courses beginning in the 2007-2008 school year– are likely to reduce the misreporting of AP codes for dual credit when the course does not serve both functions. College Board AP programs are copyrighted and therefore schools without permission to hold AP courses in a subject area should not report AP course codes to the state. However, the state coordinator did note that if a school has permission to offer an AP course, that school could offer AP dual credit overlay or simply crosswalk dual credit courses to an AP code, legitimately using an AP course code to report a dual credit course. The state dual credit expert did not mention any kind of monitoring on behalf of the state regarding the use of AP course codes; local responsibility was implied.

Non-Academic, Technical, and Academic Coursetaking

Dual credit coordinators also provided information about academic, technical, and "non-academic" coursetaking at their institutions. A coordinator from an urban college believed that, in terms of crosswalks, there is better coordination of technical crosswalks than academic crosswalks because of coordinated statewide efforts to establish links. A few college coordinators indicated little knowledge of technical dual credit coursetaking because those courses are handled by a different person on their campuses. Four of the college coordinators interviewed noted that they or others at their schools (such as technical faculty) believe technical dual credit is a better option than articulated credit programs because of its flexibility. One college representative noted that her college is considering a switch from articulated credit to dual credit for technical courses.

Credits earned through dual credit technical courses are easier to transfer and to obtain than articulated credit courses. Credit is awarded at the time a dual credit course is taken, whereas for articulated credit courses the credit is not earned until the student graduates from high school and enrolls in the college with which the articulation agreement was enacted (sometimes additional college coursework is required before the credits are transcripted).

When asked about the types of dual credit that their institutions offer, many coordinators said that academic coursetaking rates were much higher than technical coursetaking rates. While one institutional representative reported having a large contingent of technical dual credit coursetakers, others estimated that 10 percent or fewer of their dual credit students took technical courses. At the institution with large (and growing) technical enrollments, the coordinator reported a conscious effort to counsel students to take both academic and technical dual credit.

A suburban campus coordinator reported that his college is seeing more interest in "higher end" technical dual credit courses. He furnished a media/AV systems course as an example and noted that some of the more complex technical courses do transfer to designated four-year institutions, or transfer if the student stays within a specific degree program.   Another coordinator expressed concern about students taking technical dual credit courses early in high school and then waiting too long to take subsequent courses.

If students try to enroll in the next course in the series when in college, they may not have retained the foundational knowledge from the introductory course.

Another problem reported with dual credit technical courses was a lack of appropriate equipment and facilities at high schools. One specific example given relates to a course that is sometimes crosswalked for dual credit with state ACGM (academic course guide manual) college course titles and sometimes with WECM (workforce education course guide) titles: Business Computer Information Systems or BCIS. Students are required to take one unit of a technology applications course(s) for all high school diploma types. BCIS and Computer Applications are frequently taken for dual credit, as seen in the course completion data from TEA. These courses can be crosswalked with academic or technical courses, but most coordinators said they try to link them with academic college courses so they will transfer more readily. Unfortunately, if a high school does not upgrade software and equipment for computer courses when the college makes upgrades, student materials will not match the high school's outdated software and students will not be exposed to the most recent technology. Because the state eligibility requirements are lower for technical and workforce education courses, many Early College High Schools place students in these courses for dual credit as freshmen or sophomores. If the students continue in the sequence while still in high school, they are fine. If not, the software could become obsolete, or the students may have forgotten the material by the time they take enroll in college and take the sequent course in the same area.

Several college coordinators reported that they are making efforts to include more middle- and lower- performing students in dual credit programs and expanding technical dual credit programs is one way to do that. As mentioned above, early college high schools often enroll students into non-academic college courses until they meet eligibility requirements for academic courses. Fine arts, physical education, and technical courses are used for this purpose. One coordinator noted that technical and workforce education courses are a great way for lower achieving students to "get hooked" into college.

The private college coordinator noted the usefulness of dual credit courses as a career exploration option for students. She researches college courses in fields related to student career interests (often courses that are unavailable at her small high school) and encourages students to enroll to determine if they are truly interested. A physical therapy-related course served this function for two of her students: one decided against continuing in the field and the other decided to apply for admission to a college where she could pursue a physical therapy degree.

When asked about changing student populations in dual credit, one college coordinator said he thinks many high schools in his service area are reluctant to encourage middle performing students to take dual credit. A high school coordinator in another area said he encouraged all students who met the dual credit permission scores on TAKS, ACT, or SAT to take advantage of dual credit opportunities. Most, but not all of his students who chose to do the dual credit were successful. A coordinator from a rural area noted that when her district enrolled every student who met dual credit eligibility scores in dual credit courses, many of the students were not successful. Perhaps student choice is the difference in these coordinators' experiences, or college readiness levels are different at their schools. One of the college coordinators said he noticed that when middle-performing students are targeted for dual credit there is more concern about course quality issues such as course rigor and instructor expectations.

Overall, all the coordinators reported growth in dual credit programs across the board – both in technical and in academic areas. This growth is represented in the data being reported at the state level.

Program Instruction, Quality, and Rigor

Although the focus of the interview questions was on dual credit crosswalks, data, and student populations, there is much to be learned about dual credit course quality and rigor from the interview results. Policies related to crosswalks and enrollment practices can affect rigor and quality as can program alignment issues across high school and college boundaries. How these issues are negotiated can truly affect dual credit programs.

The interviews supported the findings in the dual credit agreements about instructors: all of the colleges and high schools contacted honored the requirements for instructor qualifications set out in THECB rules. The assignment of instructors to programs varies considerably across campuses. Some programs rely on college instructors, some on high school instructors, and some on both. Many high school dual credit instructors also work as adjuncts for the college on nights, weekends and in the summer. The delivery methods reported by the interview participants really varied. Although colleges are creative about finding qualified instructors to teach dual credit courses, growth pressures have made it difficult for some colleges to meet high school demand. High schools located a distance from college campuses prefer on-site options for students both in terms of cost and scheduling. The four-year college coordinator interviewed said his institution used to send instructors to high school campuses but now the program is strictly college campus-based. Because his program is small, this is effective. This coordinator reported that limiting enrollments helps ensure the quality of the dual credit programs at his institution. Access to dual credit programs is probably of less concern at four-year universities than at two-year colleges.

Student college readiness issues came up in other contexts. A high school moved their dual credit Rhetoric and Composition program from grade 11 to grade 12 because the younger students were not academically ready to handle the course work. One of the high school coordinators who participated believes that a concerted, multi-grade effort to get students more prepared for college has contributed to the growth and success of her school's dual credit program. The college which struggled with readiness when all eligible students were assigned to dual credit programs tried a new approach the next year. The school created a system where a classroom teacher (not dual credit qualified) is available to work with dual credit students on the day the college class is not broadcast to the school. This monitor makes sure TEKS are covered and helps students with comprehending the material and completing assignments. Augmenting the dual credit instruction has worked very well for these students who need a little help with college material, but are ready for more advanced work than the available high school course provides. A college which paired high school and college instructors in a team teaching environment reported success with this innovative approach. This type of intervention, unfortunately, can add significantly to the cost of offering dual credit courses.

Generally, the high school coordinators reported that the quality of college courses in their districts was quite good. One coordinator recently transferred districts, and the new district was in a different community college service area. She found a difference in quality between the college courses provided by the first college partner and those provided at her new school. Dual credit options through the new provider are distance education-based programs that the coordinator finds less effective than in-person instruction. The lack of dedicated coordinators from the new college partner adds logistical complications to course coordination and scheduling efforts which were not experienced with the previous college provider.

Reports on the quality of instruction at the college versus the high school campus varied. Two interviewees said that college instructors sent to high school campuses tend to find the students very qualified compared to traditional community college populations. However, some college faculty resist going to high school campuses and find the students less qualified, or less willing to adapt to a college system. One high school staff person said she preferred high school teachers because they have better classroom management skills with high school students and understand the population better.

Finally, a dual credit coordinator from a rural area told the researcher emphatically that “if we can’t offer a [dual credit] course effectively and appropriately with the same level of rigor, we won’t offer it.”

Dual Credit Courses and Student Grades

A measure of the level of rigor of dual credit courses can be anecdotally supported by feedback about student grades. A number of the coordinators mentioned that students are not always ready for college level work and their dual credit grades reflect that. One suburban high school coordinator said that because there is no weighting in the district, students are more willing to try college-level courses and take the risk of getting a lower grade. Concerns about ensuring that courses were linked to weighted high school courses were often based on the perception that dual credit courses are rigorous and students deserve extra grade points for their efforts. Finally, the four-year university coordinator, who also served on the admission staff, said that he has had students apply with B averages in high school and 1.0 averages in dual credit courses. He believed this was a signal that the student was not ready for college-level work.

Frequently, students who enroll in dual credit courses at a community college return to take summer courses after they have matriculated at a four-year institution. Two of the interview participants commented that they believed this would be less common if the community college programs were not of high quality. One of the participants believed dual credit enrollments can help encourage regular enrollments when students graduate. This coordinator's institution is trying to reach out and engage middle-achieving students in dual credit programs in the hopes that more students who take dual credit will enroll after high school and complete an associate's degree.

Student Maturity

A discussion about course quality and academic student readiness is a good introduction to comments about student maturity. According to the dual credit professionals, occasionally a college teacher sent to a high school campus complains about student maturity. No complaints were voiced about maturity issues with students who attend dual credit classes on a college campus. While several dual credit agreements included language about the need for student maturity, this did not emerge as a problem in the interviews. One coordinator noted that when high school students are mixed in with college students, the instructor often does not realize there are high school students in the class.

Rural Schools, Advising Issues, and Program Benefits

Some uniquely rural issues were raised by two of the high school coordinators. Rural schools tend to be smaller and therefore have fewer resources than urban or suburban schools. There are often too few students to justify advanced or AP classes for accelerated students. Dual credit provides a means to serve the students who are ready for more advanced work. One of the rural high school coordinators stressed that her students live in a farming community. Parents and even school board members expect students to grow up to be farmers. Exposing these students to college-level work is very important to this coordinator. She sees it as a means to show her students that they have options beyond their community and to give them the confidence and skills to compete if they do choose to go on to college. For those students who find that they are not as ready for college as they thought, they have the opportunity to readjust their expectations and focus on improving readiness levels while still in high school.

The topic of providing support and advising for dual credit students is an important one. Ensuring that students understand their responsibilities and the consequences of their choices was a theme that came up several times. While some dual credit agreements were submitted with forms for students to sign which outlined their rights and responsibilities as a college student, it was not clear from other agreements how much advising students' receive. The interviews highlighted that program administration, counseling, and support services are important elements of successful dual credit partnerships. Logistical issues arise when trying to coordinate efforts across the high school and college divide. Coordinators reported that providing student assistance with negotiating the college process is a critical role. While THECB rules call for dual credit students to have the same access to advising and counseling as all students who attend a college, special services for dual credit students – either in the form of assistance from high school counselors or assigned college staff –can make a difference in the success of the students who participate.

Despite some of the concerns about or drawbacks of dual credit programs that were expressed by the interviewees, without exception they expressed a high level of commitment to and enthusiasm for dual credit programs. All clearly believed the programs are of value to students, even if there was some disagreement about who is best served. Two participants, without prompting, claimed that dual credit programs are not only good for students but are good for Texas. They see dual credit as a cost effective means for students who are ready for college-level work to avoid duplication of coursework, make more productive use of their high school time, and be exposed to postsecondary options that they might not have otherwise considered or explored. One coordinator at a school with a large program said there is no "senioritis" at her school, thanks to dual credit. Although all of the coordinators interviewed might not go as far as scheduling dual credit cost/benefit analysis sessions with parents, as one interviewee did, they all clearly saw the benefits of these programs while understanding some of the challenges of reporting, alignment, and quality control. The interviewees were, in almost every instance, happy to spend much more time talking with the researcher than what was allotted to the interview process.

Summary

Overall, the interviews confirmed the variability in course crosswalks found in the crosswalk analysis, both in terms of how crosswalks are determined and which courses are linked. They provided local examples of reporting issues which helped illuminate the discrepancies in dual credit reporting observed at the state level. They also provided a more comprehensive and personal picture of the students who take dual credit courses and the instructors who teach them than could be gleaned from partnership agreements or other sources.

The next chapter explores the statewide dual credit data collected for this study and presents information about the students who take dual credit courses in Texas.

CHAPTER FIVE: DESCRIPTIVE DATA AND ANOVA RESULTS

The previous chapter explored dual credit data alignment issues from multiple perspectives and provided information about the nature and accuracy of the dual credit data available in Texas K-12 and Higher Education Data systems. The information gathered informed construction of a data file of 2004 to 2007 Texas public high school graduates who participated in dual credit programs. Chapter Five addresses how this data file was adapted to minimize previously outlined limitations. Descriptive data gleaned from the data file are then presented to provide a demographic profile of dual credit coursetakers in Texas and to show longitudinal dual credit coursetaking patterns. The descriptive data answers Research Question Two: Did the population and proportion of Texas public high school graduates who took academic dual credit courses, non-academic dual credit courses, or both change from 2004 to 2007?

Following the descriptive data results, the results of two analysis of variance (ANOVA) statistical analyses are presented. The first looks at the number of dual credit courses taken by type of course and other variables, and the second looks at differences in freshman grade point average (GPA) in several subpopulations of dual credit students. The ANOVAs were designed to answer research questions three and four:

Research Question 3: For the population of Texas public high school students who enroll in dual credit courses while in high school, does the average number of dual credit courses taken differ by type of courses taken (academic, non-academic or both), gender, economic status, race, region, type of high school attended, type of college enrollment, and persistence in the first year of college?

Research Question 4: For the population of Texas public high school students who enroll in dual credit courses, are there differences in average Grade Point Average (GPA) by type of dual credit courses taken, gender, economic status, race, region, type of high school attended, type of college enrollment, and persistence in the first year of college?

Constructing a Dual Credit Data File

Information about students who graduated from Texas public high schools in 2004, 2005, 2006, and 2007 was accessed through TEA PEIMS course completion records and TEA high school graduate records. TEA course completion records (PEIMS Record 415) were used to identify students who completed one or more dual credit courses while in high school. The course completion records were merged with the graduation records and used as the basis for two data files. The first, a file containing a list of all of the dual credit courses taken by each graduate, was used to identify dual credit course frequencies to augment the dual credit crosswalk analysis presented in Chapter 4 (see Tables A2 and A3). The completion file was used in its entirety for the course frequency counts, with the exception of two courses taken by approximately 1,500 students, mainly between 2001 and 2002 (the students were 2004 high school graduates). Based on the information known about these two courses and the high frequencies reported for them, the researcher determined they were reported in error and removed them from the file.

The second data file was constructed using several sources in addition to the two mentioned. For this file, the number of dual credit courses reported on the course completion record was tallied by course type for each student. The file was then unduplicated by student identification number so that only one record was included for each high school graduate. A variety of additional data sources were merged into the file so that demographic characteristics, high school type, region of high school enrollment, type of college enrollment, persistence in college, and freshman college GPA were included for each student record, as applicable.

This "master" data file was created to provide the cohort data necessary to answer Research Questions 2 through 4. Originally the master data file was conceived as a data source which would contain relevant information about every 2004-2007 public high school graduate who took at least one dual credit course, as identified through the PEIMS dual credit course flag. THECB does not collect data about course completion, so the course completion records were necessary to study student coursework patterns. However, the results of the multi-faceted exploration of data alignment, consistency, and accuracy outlined in Chapter Four led to adjustments in the master file. Students who were recorded with dual credit in the PEIMS system but were not recorded with dual credit semester credit hours at a Texas public higher education institution were removed from the cohort. This was done to minimize the impact of misreported dual credit courses, a problem uncovered in the data alignment research. By including only students with dual credit records in both the TEA and THECB databases in the master file, the study results are less broad but arguably more robust. The likelihood that some kind of dual credit activities were occurring is certainly higher than for students who were reported with dual credit in just one system.

What is more difficult to ascertain, using available data, is the accuracy of the course taking activities of the cohort population. Overall, the student demographic information in the database is probably a very good representation of Texas public high school students who took dual credit at a Texas public higher education institution;

however, the information about number of courses taken for those students may be less reliable because the courses cannot be linked across the systems.

Dual Credit Semester Credit Hours and Dual Credit Course Units: A Comparison

Using the dual credit data that was available for each student, the level of dual credit coursetaking reported in each system was compared to see how well the records aligned for students reported with dual credit in both systems. The number of course units for high school dual credit courses was tabulated for each student in the data file. Then each student's dual credit college semester credit hours were calculated. These two statistics were charted in a frequency table for all of the students in the cohort.

The matrix in Table 5.1 shows the results of the unit/semester credit hour distribution. There are several limitations to this comparison: a lack of summer dual credit data from TEA; the reporting of public and private/out-of-state dual credit enrollments in PEIMS; the fact that the TEKS allow for some TEA courses to be offered for different unit lengths depending on school preference; variability in the number of semester credit hours available for college courses (some courses are one semester credit hours, others as many as five); and, finally, course crosswalk study results that suggest that high schools and colleges do not or cannot always follow the TEA recommended guidelines that one high school unit equals six college hours.

Frequencies discussed in the text are highlighted in gray in the table. For students reported with one unit of dual credit in TEA, the most common frequency for THECB

Table 5.1

Estimated TEA Units Earned and THECB Dual Credit Student Semester Credit Hours Reported
2004 to 2007 Texas Public High School Graduates

CB Dual SCHs↓	Estimated Unit Total from PEIMS																				
	Unk.*	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5-13	Total
1		206	277	90	106	25	31	6	10	7			1						0		759
2		68	199	54	112	32	42	9	10	5	1										532
3		2,912	6,376	448	959	149	234	78	70	15	22	11	5	2	2						11,283
4	10	83	1,503	83	242	41	51	11	9	6	2		3	1							2,045
5		19	111	21	133	14	23	5	4	2	1										333
6		1,445	19,948	1,447	3,037	364	419	75	126	30	18	7	2	1							26,919
7		95	931	224	577	40	86	19	61	12	10	5		1							2,061
8	25	68	1,282	54	409	41	54	18	29	2	7	2			1						1,992
9		533	2,710	2,668	1,957	348	423	102	116	24	26	8	3		1					1	8,920
10	30	51	524	131	880	118	184	63	38	17	14	5	3								2,058
11		46	210	148	284	72	111	18	23	3	6	2	3	4	1						931
12		269	3,140	1,466	8,615	649	985	125	234	23	43	4	21	2	2						15,578
13	1	41	237	99	660	183	194	56	85	7	10	1	3						2		1,579
14		27	365	77	1,373	79	274	50	74	10	14		10	2	1						2,356
15		102	586	414	1,105	808	653	159	175	25	28	9	6	1	2			1			4,074
16		31	175	64	391	104	358	42	165	17	22	5	15		3						1,392
17	1	18	113	41	183	172	250	37	91	9	11	1	3	1		1					932
18		62	516	229	955	453	1,389	191	250	59	71	5	7	1	1				4	2	4,195
19	1	11	97	46	148	82	243	58	122	36	36	9	7	1	1						898
20	2	10	104	32	225	97	432	43	178	23	56	3	11				1				1,217
21		30	167	86	243	171	329	298	231	25	47	17	17	1	2	1				3	1,668
22		8	69	19	100	54	245	76	161	29	34	3	10		6						814
23		4	36	12	89	50	108	69	134	17	78	15	22	2	2		1				639
24		12	118	46	227	74	190	92	454	36	52	6	12				8				1,327
25		6	28	9	69	22	40	32	135	32	43	10	7	2	3	1		4			443
26		2	38	10	58	18	74	58	154	31	45	10	30	2	4		1			1	536
27		9	63	20	69	20	60	31	153	36	60	10	17	3	4		1			1	557
28		2	21	7	45	10	33	26	90	17	37	8	26	5	8	2	4				341

Table 5.1

Estimated TEA Units Earned and THECB Dual Credit Student Semester Credit Hours Reported
2004 to 2007 Texas Public High School Graduates (Continued)

CB Dual SCHs↓	Estimated Unit Total from PEIMS																				
	Unk.*	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5-13	Total
29		7	14	5	28	12	29	50	55	20	61	12	23	7	9	1					333
30		5	27	8	35	12	38	27	60	49	43	20	15	4	22	1	2	1			369
31		1	11	2	13	7	14	12	21	12	23	4	17	2	4			1		1	145
32			8	1	23	3	28	7	36	16	55	3	10	2	2		1		1	1	197
33		2	8	3	10	4	14	6	19	5	32	9	16	5	8	1	3		1		146
34		1	7	2	14	3	16	10	17	5	10	7	7	2	7		1			1	110
35		1	4		2		10	5	6	2	5	4	5	2	2	2	1			1	52
36			7	3	11	2	11	5	8	13	12	7	9	4	2		2	1			97
37			6		5	2	4	1	13	2	4	2	2	1	2	1	1				46
38			2		2	1	2		8	4	3		2	2	2		3	1	1		33
39			1		3	3	2		5	1	7	3	5	1	1	2	1	1			36
40			1		3		3		11		3		4		2	1					28
41		1			2		2		2		3	1			1	1	1	1		1	16
42			2		8		3		4		1		1	1	1	3	1				25
43				1			2	1	2		1	1	5	1	1	2		1			18
44			1		2		3	1	1	1	1	2	2	1	1					2	18
45										1			2	3	1	2					9
46								1	1		1	1			1				1		6
47		1				1			1			2				2					7
48			1				1	1			1									1	5
49				1	1		1						3			1		1			8
50-77		3	8	1	6		3	4		1	1		3	2	5	1	4	2	1	5	50
Total	70	6,192	40,052	8,072	23,419	4,340	7,701	1,978	3,652	687	1,061	234	375	72	118	26	37	15	11	21	98,133

* Courses for which no units could be determined

dual semester credit hours attempted was 6. Of 26,919 students in the cohort who were reported with six total dual credit semester credit hours, 19,948 students were estimated to have taken one course unit of dual credit at TEA. This aligns with TEA guidelines. A less strong correlation between TEA units and semester credit hours is seen for students who attempted three dual credit semester credit hours. There were 2,912 students reported with three dual credit semester credit hours and .5 units of high school dual credit courses, which fits the guidelines. But there were more than twice as many students -- 6,376 in all -- reported with three dual credit semester hours and 1.0 units of high school dual credit. One or more of the data limitations cited above may be responsible for this apparent lack of alignment. Or this could represent a large number of students who are flagged as taking a 1.0 unit high school course for dual credit but actually drop or fail the college-level course during or at the end of the first semester of college work (THECB collects semester credit hours attempted in dual credit courses so an unsuccessful student would be reported).

The highest frequencies in the rows for students at 6, 12, 18, and 24 semester credit hours do link with expected TEA unit values in the columns. However, it is important to note that there are a large number of student frequencies that do not fall into expected cells at these credit levels. At some other credit levels, notably the 9, 15, and 21 semester credit hour points, the highest frequencies do not fall where expected. This suggests that, for students who are reported in both systems, the reporting process appears to be capturing dual credit linkages across the data systems reasonably well but not without some degree of error.

Dual Credit Course Participation in Texas: 2004-2007 High School Graduates

After the removal of students who were not reported with dual credit identifiers in both systems, the master data file of 2004-2007 high school graduates dropped from 127,065 student records to 98,133 student records. Overall, seventy-seven percent of the 2004-2007 high school graduates had one or more dual credit flags in PEIMS and one or more dual credit semester credit hours reported by a Texas public college. This cohort of students was used for the descriptive and inferential statistical analyses of dual credit students in Texas. In addition, data about all Texas public high school students who graduated from 2004 to 2007 were compiled using the same variables and protocols as those used for the dual credit data file. This data provide a means to compare the population of students in the cohort who took dual credit courses from 2004 to 2007 (the "dual credit cohort") to the full cohort of high school graduates for the cohort years (the "all graduates" cohort).

2004-2007 Dual Credit Cohort Compared to the All Graduates Cohort

The population of students in the dual credit cohort is a subpopulation of the students who graduated from a public high school from 2004 to 2007. Table 5.2 on the following page shows the percentage of dual credit cohort students by each of the main variables studied. Demographic information about the all graduates cohort is also included for several categories. Overall, the dual credit cohort grew each year from 2004 to 2007, while the all graduate population had smaller and less consistent fluctuations in

Table 5.2: Dual Credit Students (TEA and THECB) and All Students by Graduation Year and Demographic Categories

		TEA Graduates WhoTook Dual Credit Courses					All TEA 04-07 Grads*
		2004	2005	2006	2007	Total 04-07 Grads (Dual)	
Count of All Students →		**20,204**	**22,969**	**24,889**	**30,071**	**98,133**	**965,564**
Measure	Category						
Gender	Female	59.1%	59.1%	59.1%	58.4%	58.9%	50.3%
	Male	40.9%	40.9%	40.9%	41.6%	41.1%	49.7%
Ethnicity	Native Am.	0.3%	0.3%	0.4%	0.4%	0.4%	0.3%
	Asian	3.7%	3.5%	3.5%	3.9%	3.6%	3.7%
	African Am	4.5%	5.0%	4.8%	5.4%	5.0%	13.5%
	Hispanic	23.1%	25.2%	27.9%	29.1%	26.6%	35.4%
	White	68.5%	66.0%	63.4%	61.2%	64.4%	47.1%
Economic Background	Dis.	16.6%	18.2%	19.8%	23.0%	19.8%	32.1%
	Not Dis.	83.4%	81.8%	80.2%	77.0%	80.2%	67.9%
CB Region	High Plains	7.4%	8.9%	8.2%	7.4%	8.0%	3.7%
	Northwest	3.7%	3.1%	2.3%	2.4%	2.8%	2.6%
	Metroplex	13.7%	13.6%	13.1%	15.8%	14.2%	25.6%
	Upper East	3.5%	4.4%	3.9%	3.6%	3.9%	4.7%
	Southeast	3.4%	3.1%	3.1%	2.9%	3.1%	3.2%
	Gulf Coast	25.3%	23.8%	25.4%	24.5%	24.7%	23.5%
	Central	8.5%	9.7%	9.9%	9.8%	9.5%	10.4%
	South Texas	27.9%	26.8%	28.1%	26.7%	27.3%	19.8%
	West	5.3%	4.5%	3.2%	4.1%	4.2%	2.6%
	Upper Rio Grande	1.3%	2.0%	2.7%	2.7%	2.3%	3.9%
	Unknown	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
HS District Type	Urban/Sub High	23.8%	23.8%	24.4%	24.3%	24.1%	22.4%
	Urban/Sub Low	54.2%	53.5%	55.3%	57.0%	55.2%	62.1%
	Rural	22.0%	22.7%	20.3%	18.7%	20.7%	13.8%
	Unknown	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%
College Enrollment Type **	Texas Four-year	58.5%	57.1%	57.1%	55.3%	56.8%	Unknown
	Texas Two-Year	23.3%	24.9%	24.9%	24.9%	24.6%	
	Unknown	18.2%	18.0%	18.0%	19.8%	18.6%	
Type of Dual Credit Taken	Academic	88.0%	87.7%	86.2%	83.3%	86.0%	N/A
	Count	17,783	20,134	21,462	25,056	84,435	
	NonAcademic	5.8%	6.5%	7.3%	8.6%	7.2%	
	Count	1,177	1,496	1,820	2,601	7,094	
	Both	6.2%	5.8%	6.5%	8.0%	6.7%	
	Count	1,244	1,339	1,607	2,414	6,604	

*Includes both dual credit and non-dual credit students

** Includes enrollment in public and private institutions in Texas size, with less than 0.5 percent difference in the population between the highest and lowest years of enrollment (2004 was the highest with 244,165 graduates, 2005 was the lowest with 239,716 graduates and 2006 and 2007 totals fell between the two). The dual credit cohort, in comparison, showed steady growth, increasing from 8.3 percent of the 2004 all graduate population (20,204 dual credit students) to 12.5 percent of the 2007 all graduate population (30,071 dual credit students).

Of the 98,133 students in the dual credit cohort, almost sixty percent were female, compared to 50 percent of students in the all graduates category. Ethnicity percentages in the cohort also differed from the all graduate population: the dual credit cohort had a higher percentage of white students than did the all graduates cohort, the percentage of Asian students was similar for both groups, and the percentage of Hispanic and African American students in the dual credit cohort was lower than the overall population. However, ethnicity percentages shifted over the four years studied, with the Hispanic population growing steadily each year from 23.1 percent of the cohort total in 2004 to 29.1 percent in 2007. White students dropped as a percentage of the total from 68.5 percent to 61.2 percent despite overall participation rates increasing by approximately 5,000 white students. Participation of students in all categories increased in terms of overall count, with Hispanic participation growing by over 4,000 students between 2004 and 2007.

Students who were not economically disadvantaged (not coded as receiving free or reduced lunch in the PEIMS database) made up a larger portion of the dual credit cohort than of the all-graduate population. Approximately 80 percent of dual credit students were classified as not economically disadvantaged versus about 68 percent of the all-graduate population. Both cohorts showed an upward trend in the number of economically disadvantaged students. Economically disadvantaged students made up 16.6 percent of the dual credit cohort in 2004 and 23 percent of the cohort in 2007.

Economic Status by Ethnicity, Gender, and Gender and Type of High School

Tables 5.3 and 5.4 provide additional details on economic disadvantage by ethnicity, gender, and type of high school. When economic status was considered by ethnicity across both populations (the dual credit cohort and the all-graduates cohort), the data showed that eight percent of economically disadvantaged Asian students participated in dual credit programs from 2004-2007 as compared a 11 percent participation rate for non-disadvantaged Asian students. For white students, the participation rate for disadvantaged students was about seven percent, considerably lower than the 15 percent of white dual credit coursetakers who were not economically disadvantaged. Three percent of all African American disadvantaged students took dual credit courses compared to a little over four percent of non-disadvantaged African Americans and seven percent of disadvantaged Hispanic students took dual credit compared with nine percent of non-disadvantaged Hispanics.

When gender was examined by economic status (see Table 5.4), the ratio of males to females for disadvantaged students in the dual credit cohort was 38.5 percent to 61.5 percent respectively, versus a ratio of 41.7 percent males and 58.3 percent females in the non-disadvantaged dual credit population. When further disaggregated by type of high school attended, the urban/suburban high readiness schools had the largest gender

Table 5.3

2004 to 2007 Texas Public High School Graduates who took Dual Credit Courses by Ethnicity and Economic Status

Economic Status	Ethnicity	Dual Credit Count	All Student Population	Percent Dual Credit
DIS	Native Am.	54	738	7.3%
	Asian	652	7,854	8.3%
	African Am.	1,585	55,545	2.9%
	Hispanic	13,343	194,184	6.9%
	White	3,761	51,987	7.2%
DIS Total		19,395	310,308	6.3%
NON DIS	Native Am.	297	2,463	12.1%
	Asian	2,918	27,457	10.6%
	African Am.	3,290	74,806	4.4%
	Hispanic	12,797	147,581	8.7%
	White	59,436	402,931	14.8%
NON DIS Total		78,738	655,238	12.0%

Table 5.4

2004 to 2007 Texas Public High School Graduates who took Dual Credit Courses by Gender, Economic Status, and type of High School

Economic Status	HS Type	Female	Male	% Female	% Male	Grand Total
DIS	Ur/Sub High	1,071	567	65.4%	34.6%	1,638
	Ur/Sub Low	8,732	5,515	61.3%	38.7%	14,247
	Rural	2,116	1,394	60.3%	39.7%	3,510
DIS Total		11,919	7,476	61.5%	38.5%	19,395
NON DIS	Ur/Sub High	12,919	9,090	58.7%	41.3%	22,009
	Ur/Sub Low	23,203	16,681	58.2%	41.8%	39,884
	Rural	9,757	7,088	57.9%	42.1%	16,845
NON DIS Total		45,879	32,859	58.3%	41.7%	78,738

imbalance for economically disadvantaged students with 34.6 percent male and 65.4 percent female students who took dual credit. The rural schools had the smallest difference in participation rates between genders for both economically disadvantaged and non-disadvantaged students.

Regional Differences in Dual Credit Participation

Table 5.2 (page 186) shows regional differences in dual credit participation across Texas. The percent of students in the all graduate population by THECB region is compared to the percent of students in the dual credit population. Longitudinal trends are also provided.

Based on the dual credit cohort results, the South Texas region had the largest percentage of dual credit participation of all THECB regions and the largest overall number of students participating for each region for every year studied. Since South Texas had the third highest percentage in the state for the 2004-2007 all-graduate high school population (coming after the Metroplex and Gulf Coast regions), the area's dual credit participation rate was quite high. The South Texas region includes both the lower Rio Grande Valley and the San Antonio area.

The High Plans region had a low population of high school graduates compared to several other regions, but it had more than double the percentage of dual credit participants as compared with the all-graduate cohort (8.0 percent of the dual credit cohort came from the High Plains area versus only 3.7 percent of the all-graduate cohort). The West region also had a high percentage of students in the dual credit cohort compared to its all-graduate population. This indicates strong dual credit participation in rural areas, which aligns with perceptions in the field about rural dual credit participation.

The Northwest, Upper East, Southeast, Gulf Coast, and Central Texas regions all had dual credit participation percentages that were within 1.5 percent of the total percent of graduates from the region. In other words, dual credit participation as a percent of total high school graduates was similar for these regions. The Metroplex and Upper Rio Grande had low dual credit cohort population percentages compared to the total percent of all graduate populations for these regions. The difference for the Metroplex was substantial.

Examining the regional dual credit participation rates from a longitudinal perspective, there were not straightforward trends. Most regions fluctuate up and down within a limited range when percentage of dual credit participation is compared to statewide dual credit participation over time.

Type of High School Attended

Data about the type of high school attended (by district) is also highlighted in Table 5.2. While information about type of high school was available for all of the dual credit students, slightly less than two percent of the all graduates population could not be linked to a high school type due to database and time constraints. Since rural school counties were easily identified using the Metropolitan Suburban Area (MSA) data from the Texas State Demographer's Office, the unidentified two-percent were assumed to fall into the two urban/suburban categories.

A total of 24.1 percent of the students in the dual credit cohort attended urban/suburban high readiness high schools (U/S HR), compared to a slightly lower percentage – 22.4 percent – of the all graduate population. Urban/suburban low readiness high schools (U/S LR) were attended by 55.2 percent of the dual credit cohort students and 62.1 percent of the all graduate cohort. And rural school attendees made up 20.7 percent of the dual credit cohort but a smaller 13.8 percent of the 2004-2007 public high school graduate population, also confirming strong dual credit participation at rural high schools. However, when the number of dual credit courses taken was tabulated by type of high school, students at U/S LR high schools took more dual credit courses, on average, than students at U/S HR high schools. Over 57 percent of the dual credit courses taken by students in the cohort were taken by U/S LR high school students.

College Enrollment, Persistence, and GPA Data

This section presents college enrollment numbers and rates for the 2004-2007 dual credit cohort, along with college freshman grade point averages (GPA) and first year college persistence. While information for the all graduate cohort is not provided for these categories, statewide-level data from the THECB accountability system will be provided for context. Enrollment results presented include all 98,133 students in the dual credit cohort (presented at the bottom of Table 5.2); persistence rates were calculated only for dual credit cohort students who enrolled in a Texas public or private college immediately following high school graduation: a total of 79,903 students (see table 5.5). Because the persistence rate tabulations included Texas private colleges and freshmen GPA data is only available for Texas public college enrollees, GPA data is presented for the subpopulation of those enrollees (68,368 students) who attended a Texas public college or university sometime during the year following high school graduation.

A total of 56.8 percent of the dual credit cohort enrolled in a Texas public or private four-year college or university upon high school graduation. An additional 24.6 percent enrolled in a Texas public or private two-year college (including community, two-year technical, and junior colleges). Finally, 18.6 percent of the dual credit cohort did not enroll in a Texas public or private institution. Because the data available from other states is limited, it is unknown how many of these students enrolled in an out-of-state higher education institution. National Student Clearinghouse (NSC) data available at the THECB was accessed to determine how frequently a student in the cohort showed up in the NCS data as enrolled in higher education outside the state. However, not all higher education institutions provide data to the NCS system. Based on what was available, at least 2,000 students from the cohort could be tracked to some type of out-of-state enrollment after high school.

Students in the cohort who enrolled in college the spring after high school graduation were not included in the higher education enrollee population because of the need for consistent full-year persistence data. Several hundred dual credit cohort students fell into this category. Some may have been students who began college at an out-of-state institution and chose to transfer after one semester. Others may have delayed their college start. Overall, the 18.6 percent non-enrollment/unknown enrollment rate must be understood in the context of this information.

Of the 79,903 students in the dual credit cohort who enrolled in Texas two- and four-year colleges and universities, 88.7 percent were still enrolled the following fall at either their initial institution or at another Texas public or private higher education institution. Of those students, 93.1 percent who enrolled in four-year institutions after high school graduation were still matriculated a year later and 78.6 percent who enrolled in two-year institutions were still enrolled. Table 5.5 below shows persistence rates for this subpopulation of the cohort by type of college enrollment, and Table 5.11 on page 209 shows persistence rates by type of college enrollment by type of dual credit course.

Table 5.5

One-Year Persistence of 2004-2007 High School Graduates who took Dual Credit Courses (Total Count 79,903)

Type Inst.	Persist?	2004	2005	2006	2007	All Years
All Students	Count →	16,531	18,830	20,417	24,125	79,903
	Yes	89.3%	88.0%	88.9%	88.8%	88.7%
	No	10.7%	12.0%	11.1%	11.2%	11.3%
4 Year	Count →	11,815	13,110	14,218	16,627	55,770
	yes	93.3%	92.4%	93.4%	93.3%	93.1%
	no	6.7%	7.6%	6.6%	6.7%	6.9%
2 Year	Count →	4,716	5,720	6,199	7,498	24,133
	yes	79.1%	78.0%	78.6%	78.7%	78.6%
	no	20.9%	22.0%	21.4%	21.3%	21.4%

The THECB accountability system reports one-year persistence rates for first-time full-time undergraduates as a success measure. The one-year persistence rate for Texas higher education institutions in 2007 was 87.6 percent for four-year university enrollees and 66.2 percent for 18 to 21 year old community colleges enrollees. Based on this comparison, dual credit students are persisting at higher rates that the overall student population. However, direct comparisons cannot be made because the accountability cohorts differed from the all-graduates cohort developed for this study (and of which the 2004-2007 dual credit cohort is a subset).

One-year college persistence rates show little variation over time in the dual credit cohort (see Table 5.5). While the percentage of students who did not persist went up slightly from 2004 to 2005, it dropped in 2005 and went up to almost 2004 levels in 2006. A 0.1 percentage point drop in persistence occurred from 2006 to 2007. This variation is slight given the much increased population of dual credit students from 2004-2007.

Freshman year grade point average (GPA) was calculated for all students in the dual credit cohort who enrolled in a Texas public college or university (see Table 5.6). Over time, there was a slight but steady drop in the college freshman GPA for dual credit students from 2.78 to 2.69 as dual credit enrollments rose.

Table 5.6

Mean College Freshman GPA of 2004-2007 High School Graduates who took Dual Credit Courses by High School Graduation Year, 2004-2007

	2004	2005	2006	2007	All Years
Count →	14,108	15,975	17,544	20,741	68,368
Mean GPA	2.787	2.746	2.729	2.694	2.734
Standard Deviation	.827	.850	.854	.870	.854

Dual Credit Course Types

Longitudinal data that show changes in the population and proportion of Texas public high school graduates who took academic dual credit courses , non-academic dual credit courses, or both from 2004 to 2007 is presented in this section. Dual credit courses were tracked by number and type of course for academic dual credit courses and non-academic dual credit courses. A variable showing type of dual credit participation was created which grouped students into three categories: students who took only academic dual credit courses, students who took only non-academic dual credit courses and students who took both. Data for this variable was disaggregated by gender, ethnicity, economic status, THECB region, type of high school attended, type of college attended, one-year persistence rate, and freshman GPA. Overall enrollments and subpopulation enrollments, including information about proportions of students in each category and sub-category, are presented in Table 5.7, which includes type of coursetaking by gender, economic status, and ethnicity, Table 5.8, which includes type of high school and type of college, and Table 5.9, which shows type of courses by region. Table 5.11 shows type of course disaggregated by one-year persistence in college and college enrollment type.

Course Type by Gender

When considering types of courses taken by gender, different patterns can be discerned. Although the percentage of academic dual credit courses taken by female students was just under 60 percent, the percentage of females who took non-academic courses (out of the total population of non-academic coursetakers) was 10 percent lower at 49.6 percent. Longitudinally, the percentage of males and females taking non-academic courses fluctuated more than the gender percentages seen for students taking academic courses. In the first two graduation years, the percentage of males taking non-academic courses was higher than the percentage of females. By 2006, that situation had reversed.

Course Type by Ethnicity

Examining course types by ethnicity reveals that white students made up the majority (68.7 percent) of academic coursetakers in the cohort. Non-academic dual credit coursetakers, however, were 59.3 percent Hispanic, 29.4 percent white and 9.0 percent African American. For students who took both course types, the white and Hispanic populations had a less than three percentage point difference separating them: white cohort members constituted 47 percent of the students who took both types of courses and Hispanic coursetakers constituted 44.7 percent of the group.

Over time, the percentage of white students in all three categories dropped considerably. The Hispanic proportion of students taking only academic courses grew from 2004 to 2006 and dropped slightly in 2007, whereas the proportion of Hispanic students taking non-academic courses grew steadily every year. African American student participation fluctuated, albeit within a small range, across the four years followed. More detail is provided in Table 5.7.

Course Type by Economic Status

Economic status makes a difference in dual credit course participation by course type. While economically disadvantaged students made up only 16 percent of the academic dual credit coursetakers in the cohort, they make up 50.7 percent of the non-

Table 5.7

Dual Credit Course Enrollment by Type of Course and HS Graduation Year (Gender, Economic Status, Ethnicity)

Type of Dual Credit	Variable	2004	2005	2006	2007	Grand Total
	Gender					
Academic	Count→	17,783	20,134	21,462	25,056	84,435
	Female	60.2%	59.6%	59.5%	59.2%	59.6%
	Male	39.8%	40.4%	40.5%	40.8%	40.4%
Non-Academic	Count→	1,177	1,496	1,820	2,601	7,094
	Female	43.4%	49.6%	52.4%	50.5%	49.6%
	Male	56.6%	50.4%	47.6%	49.5%	50.4%
Both	Count→	1,244	1,339	1,607	2,414	6,604
	Female	58.8%	62.1%	61.4%	58.7%	60.0%
	Male	41.2%	37.9%	38.6%	41.3%	40.0%
	Economic Status					
Academic	Count→	17,783	20,134	21,462	25,056	84,435
	DIS	14.7%	15.1%	16.1%	17.5%	16.0%
	NDIS	85.3%	84.9%	83.9%	82.5%	84.0%
Non-Academic	Count→	1,177	1,496	1,820	2,601	7,094
	DIS	38.7%	49.2%	49.7%	57.7%	50.7%
	NDIS	61.3%	50.8%	50.3%	42.3%	49.3%
Both	Count→	1,244	1,339	1,607	2,414	6,604
	DIS	23.6%	30.3%	36.0%	42.9%	35.0%
	NDIS	76.4%	69.7%	64.0%	57.1%	65.0%
	Ethnicity					
Academic	Count→	17,783	20,134	21,462	25,056	84,435
	Native American	0.3%	0.4%	0.4%	0.4%	0.4%
	Asian	3.7%	3.6%	3.7%	4.1%	3.8%
	African American	4.2%	4.7%	4.4%	5.2%	4.6%
	Hispanic	20.4%	22.0%	23.7%	23.3%	22.5%
	White	71.4%	69.4%	67.8%	67.0%	68.7%
Non-Academic	Count→	1,177	1,496	1,820	2,601	7,094
	Native American	0.3%	0.1%	0.2%	0.2%	0.2%
	Asian	2.9%	2.3%	2.2%	1.7%	2.1%
	African American	7.9%	8.3%	10.8%	8.8%	9.0%
	Hispanic	50.1%	55.7%	61.4%	63.9%	59.3%
	White	38.7%	33.6%	25.4%	25.4%	29.4%
Both	Count→	1,244	1,339	1,607	2,414	6,604
	Native American	0.6%	0.1%	0.2%	0.2%	0.2%
	Asian	3.9%	3.1%	2.7%	3.9%	3.4%
	African American	5.0%	6.4%	4.2%	3.8%	4.6%
	Hispanic	35.8%	38.8%	45.3%	52.2%	44.7%
	White	54.8%	51.7%	47.6%	40.0%	47.0%

academic dual credit coursetakers. For students who took both academic and non-academic dual credit courses, the percentage of disadvantaged students fell in the middle at 35 percent. Over time, the percentage of economically disadvantaged dual credit coursetakers grew in all three coursetaking categories, a trend that was seen in the overall dual credit cohort data in Table 5.2.

Course Type by Type of High School District

Studying types of dual credit coursetaking by type of high school district (see Table 5.8) reveals that the number and percentage of students from urban/suburban high readiness high schools who took academic dual credit courses grew each year from 2004 to 2007. Students from urban/suburban low readiness high schools fluctuated in participation rates in academic courses, as did students from rural schools. As in most cases, while the percentages fluctuated, the number of students participating in each category grew during the four year study period.

For non-academic coursetaking, participation at urban/suburban low readiness high schools grew steadily, with 8 percent more students taking these courses over the four year period. A large majority, 84.1 percent, of the subpopulation of the cohort that took non-academic dual credit courses only were enrolled in urban/suburban low readiness high schools.

For students who took both academic and non-academic courses, the greatest percentage change was also seen at urban/suburban low readiness schools with a 10 percent increase in participation percentage over four years from 60.1 percent of the total subpopulation in 2004 to 70.7 percent in 2007. Both rural and urban/suburban high

Table 5.8

Dual Credit Course Enrollment by Type of Course and HS Graduation Year (Type of High School, Type of College Enrollment)

Type of Dual Credit	Variable	2004	2005	2006	2007	Grand Total
	Type of High School (District)					
Academic	Count→	17,783	20,134	21,462	25,056	84,435
	Ur/Sub High	25.1%	25.2%	26.3%	27.2%	26.0%
	Ur/Sub Low	52.1%	50.8%	51.9%	52.5%	51.9%
	Rural	22.8%	24.0%	21.7%	20.4%	22.1%
Non-Academic	Count→	1,177	1,496	1,820	2,601	7,094
	Ur/Sub High	11.4%	11.4%	9.0%	6.3%	8.9%
	Ur/Sub Low	79.5%	80.2%	85.6%	87.5%	84.1%
	Rural	9.1%	8.4%	5.4%	6.3%	7.0%
Both	Count→	1,244	1,339	1,607	2,414	6,604
	Ur/Sub High	17.4%	16.3%	16.2%	14.0%	15.6%
	Ur/Sub Low	60.1%	64.2%	65.3%	70.7%	66.1%
	Rural	22.4%	19.5%	18.4%	15.4%	18.3%
	Type of College Enrollment					
Academic	Count→	17,783	20,134	21,462	25,056	84,435
	Unknown	17.0%	17.0%	17.0%	18.3%	17.4%
	4 Year	60.4%	59.2%	59.3%	57.7%	59.0%
	2 Year	22.6%	23.9%	23.7%	23.9%	23.6%
Non-Academic	Count→	1,177	1,496	1,820	2,601	7,094
	Unknown	37.1%	34.8%	31.9%	36.7%	35.1%
	4 Year	29.3%	27.7%	28.5%	30.2%	29.1%
	2 Year	33.6%	37.5%	39.6%	33.1%	35.8%
Both	Count→	1,244	1,339	1,607	2,414	6,604
	Unknown	17.0%	14.9%	15.4%	16.6%	16.1%
	4 Year	58.1%	58.4%	60.8%	56.9%	58.4%
	2 Year	24.8%	26.7%	23.8%	26.5%	25.6%

readiness schools showed decreases in the percentage of students who took non-academic dual credit or both course types.

Course Type by Type of College Enrollment

Also shown in Table 5.8 are data about college enrollment by type of dual credit courses taken. Students who took academic courses only were more likely to enroll in a four-year college than a two-year college (59 percent at the former and 23.6 percent at the latter). A total of 17.4 percent of students in the academic only group fell into the unknown enrollment group. Students who took only non-academic courses look much different than their academic-only counterparts. Of this group, 29.1 percent enrolled in a four-year college, 35.8 percent enrolled in a two-year college, and 35.1 percent did not enroll in a Texas college or university the fall following high school graduation. As non-academic courses are often technical courses that will articulate toward a technical two-year college degree, the higher percentage of two-year college enrollments for this group was not unexpected. Finally, it is notable that the percentage of students who did not enroll in college or whose enrollment was unknown was twice as high for students enrolled in non-academic dual credit courses only as compared to students enrolled in academic dual credit courses only.

For students who took both academic and non-academic dual credit courses, the non-matriculation/unknown rate was the lowest of the three coursetaking types, at 16.1 percent; the four-year enrollment percent was almost the same as for students taking academic dual credit only (58.4 percent); and the two-year rate was two percentage points higher than for students who took academic courses only.

Course Type by Region

Large differences in academic only, non-academic only, and both dual credit coursetaking patterns were seen when the cohort data was disaggregated by region and course type (see Table 5.9). Academic coursetaking by region closely resembled the overall dual credit coursetaking patterns by region seen in Table 5.2. One notable difference was that the Gulf Coast had a slightly higher number of academic coursetakers than South Texas, and therefore the highest percent of academic dual credit coursetakers out of the dual credit cohort (although South Texas still had a higher percent academic coursetakers when adjusted for the percent of the total all graduate cohort population for the regions).

Non-academic coursetaking varied considerably by region. A full 46 percent of the total number of 2004-2007 Texas public high school graduates who took only non-academic dual credit courses graduated from a high school in the South Texas region. Whereas, for some regions, non-academic dual credit course participation was minimal. For example, only 0.7 percent of all non-academic only coursetakers was from the Southeast region and an even smaller 0.4 percent was from the Upper Rio Grande region.

The South Texas region also had the highest percentage of the total number of students who took both academic and non-academic dual credit courses (41.8 percent). Coursetaking in this category grew from 32.8 percent to 51.2 percent over the four-year period studied. The High Plains region has the second highest percentage of students in the "both" category with 16.1 percent participation from students in the dual credit

Table 5.9

Dual Credit Course Enrollment by Type of Course and HS Graduation Year (by Coordinating Board Region)

Type of Dual Credit	Variable	2004	2005	2006	2007	Grand Total
	CB Region					
	Count→	17,783	20,134	21,462	25,056	84,435
	High Plains	7.4%	8.5%	7.8%	7.1%	7.7%
	Northwest	3.9%	3.2%	2.5%	2.7%	3.0%
	Metroplex	12.7%	13.2%	13.3%	17.5%	14.4%
	Upper East	3.5%	4.5%	4.1%	3.9%	4.0%
Academic	Southeast	3.8%	3.4%	3.5%	3.2%	3.4%
	Gulf Coast	27.3%	25.5%	26.5%	26.1%	26.3%
	Central	8.7%	10.2%	10.7%	10.8%	10.2%
	South Texas	26.9%	25.1%	25.5%	21.9%	24.6%
	West	4.8%	4.3%	3.1%	3.5%	3.8%
	Upper Rio Grande	1.1%	2.2%	3.0%	3.2%	2.5%
	Count→	1,177	1,496	1,820	2,601	7,094
	High Plains	3.4%	5.6%	3.7%	3.2%	3.9%
	Northwest	1.2%	1.2%	0.5%	0.5%	0.8%
	Metroplex	26.1%	23.2%	15.5%	9.7%	16.8%
	Upper East	2.1%	1.6%	0.9%	0.6%	1.1%
Non-Academic	Southeast	0.4%	0.1%	0.8%	1.1%	0.7%
	Gulf Coast	10.1%	11.8%	23.8%	20.9%	17.9%
	Central	7.6%	6.8%	3.8%	4.7%	5.4%
	South Texas	38.7%	42.6%	47.3%	50.2%	46.0%
	West	10.4%	6.9%	3.0%	8.5%	7.1%
	Upper Rio Grande	0.0%	0.3%	0.5%	0.5%	0.4%
	Count→	1,244	1,339	1,607	2,414	6,604
	High Plains	12.1%	19.0%	18.5%	14.9%	16.1%
	Northwest	2.7%	3.3%	2.1%	1.3%	2.2%
	Metroplex	16.3%	9.7%	8.3%	4.3%	8.7%
	Upper East	5.2%	6.6%	4.9%	3.7%	4.9%
Both	Southeast	0.7%	1.7%	1.4%	1.8%	1.5%
	Gulf Coast	9.8%	11.6%	12.1%	11.7%	11.4%
	Central	5.9%	5.6%	6.1%	5.0%	5.6%
	South Texas	32.8%	35.2%	40.3%	51.2%	41.8%
	West	8.5%	5.6%	5.2%	5.7%	6.1%
	Upper Rio Grande	5.9%	1.8%	1.1%	0.4%	1.9%

coursetaker cohort. Since only 3.7 percent of students in the all graduate cohort come from the High Plains region, having this high a level of student participation merits acknowledgment.

Over time, the Metroplex has increased in the number of academic dual credit courses taken and decreased in terms of non-academic courses. In actual numbers, students who took non-academic courses only took 307 courses in 2004 and 252 in 2007. In contrast, in the South Texas region, the percentage of non-academic courses taken went from 38.7 percent of all courses to 50.2 percent, an increase from 455 non-academic courses to 1,305 non-academic courses. The Gulf Coast also saw a large increase in students who took only non-academic courses from 2004 to 2007. And although the region gained a substantial number of graduates who took academic courses from 2004 to 2007, and had the highest percentage of high school graduates who took academic dual credit courses for every year studied, the overall percent of the academic dual credit coursetaking population dropped slightly during that time due to increases in academic coursetaking in other regions.

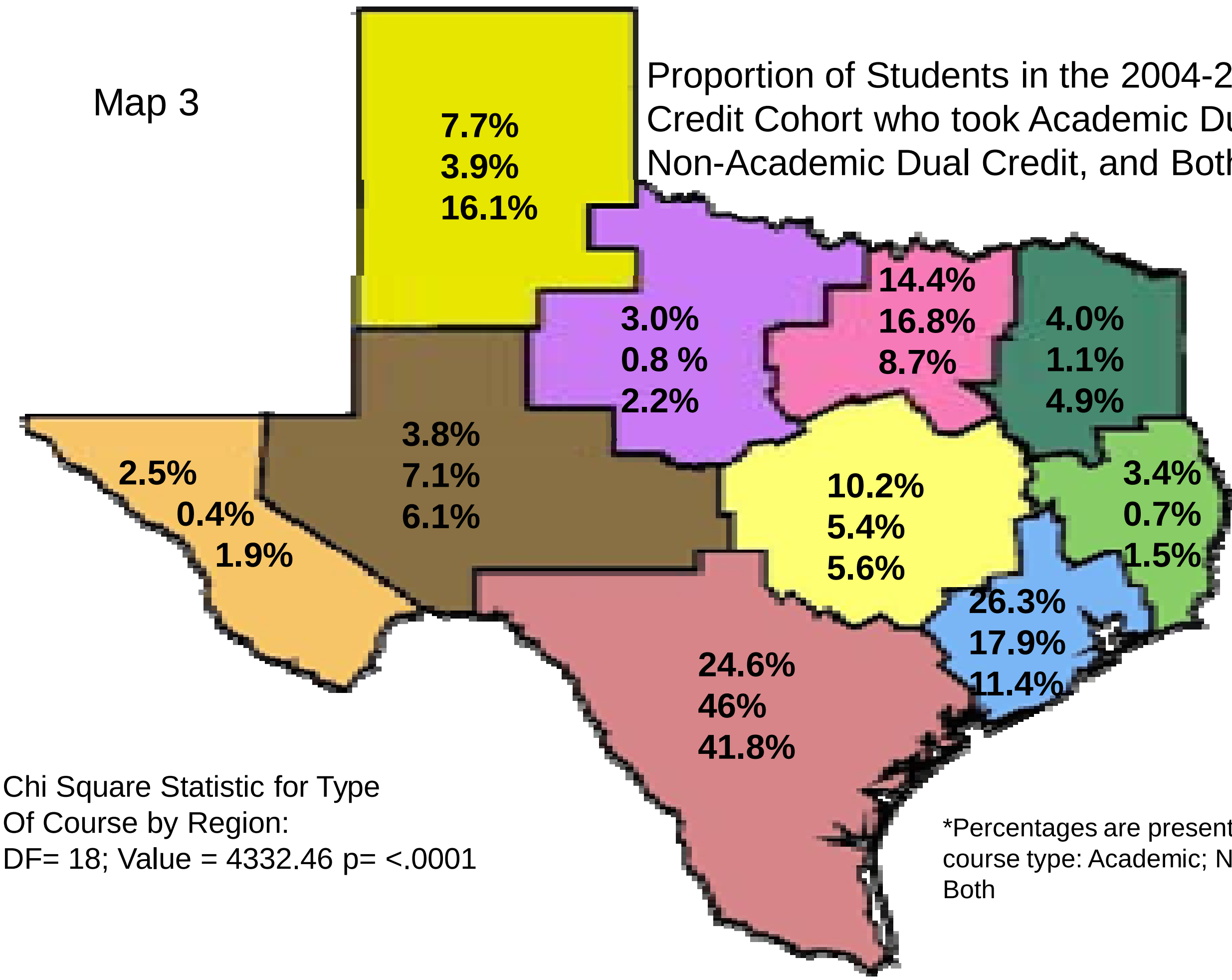
Map 3 on the following page illustrates types of dual credit participation by region. The first figure in each region is the percent of academic only coursetakers in the dual credit cohort, the second represents the percent of non-academic coursetakers in the cohort, and the third represents the percent of students who took both.

Chi Square Test of Differences in Course Types Across Regions

Regional differences were not studied by number of courses taken in the analysis of variance tests conducted as part of this study due to the large number of interactions

Map 3

Proportion of Students in the 2004-2007 Dual Credit Cohort who took Academic Dual Credit, Non-Academic Dual Credit, and Both.



Chi Square Statistic for Type Of Course by Region:
DF= 18; Value = 4332.46 p= <.0001

*Percentages are presented in order of course type: Academic; Non-Academic; Both

Table 5.10

2004 to 2007 Texas Public High School Graduates who took Dual Credit Courses

Region by Type of Course Taken (Chi Square Table)

Region	Academic	Both	Non-Acad.	**Total**	
High Plains	6,489	1,061	275	7,825	Freq.
	6.6	1.1	0.3	8.0	percent
	82.9	13.6	3.5		row percent
	7.7	16.1	3.9		column percent
Northwest	2,564	142	56	2,762	
	2.6	0.1	0.1	2.8	
	92.8	5.1	2.0	100.0	
	3.0	2.2	0.8		
Metroplex	12,143	572	1,190	13,905	
	12.4	0.6	1.2	14.2	
	87.3	4.1	8.6	100.0	
	14.4	8.7	16.8		
Upper East	3,391	322	81	3,794	
	3.5	0.3	0.1	3.9	
	89.4	8.5	2.1	100.0	
	4.0	4.9	1.1		
Southeast	2,891	97	51	3,039	
	3.0	0.1	0.1	3.1	
	95.1	3.2	1.7	100.0	
	3.4	1.5	0.7		
Gulf Coast	22,217	754	1,272	24,243	
	22.6	0.8	1.3	24.7	
	91.6	3.1	5.3		
	26.3	11.4	17.9		
Central	8,620	367	382	9,369	
	8.8	0.4	0.4	9.6	
	92.0	3.9	4.1		
	10.2	5.6	5.4		
South Texas	20,800	2,763	3,260	26,823	
	21.2	2.8	3.3	27.3	
	77.6	10.3	12.2		
	24.6	41.8	46.0		
West	3,247	402	501	4,150	
	3.3	0.4	0.5	4.2	
	78.2	9.7	12.1		
	3.9	6.1	7.1		
Upper Rio Grande	2,073	124	26	2,223	
	2.1	0.1	0.0	2.3	
	93.3	5.6	1.2		
	2.5	1.9	0.4		
Total	84,435	6,604	7,094	98,133	
	86.04	6.73	7.23	100	

Course Type spans Academic, Both, Non-Acad.

Statistic	**DF**	**Value**	**Prob**
Chi-Square	**18**	**4332.465**	**<.0001**

involved. The study included a chi square test to determine whether regional differences by course types were significant. Not surprisingly, the chi square test established that there were significant differences by region in the type of courses attempted ($p < .0001$). The results are included in Table 5.10 and mirror the results discussed here and in Table 5.9, except that additional proportions were included in the Chi Square table and longitudinal differentiations were not.

Why Does South Texas Look Different?

Information learned in the dual credit coordinator interview phase of the research helped illuminate the high levels of non-academic dual credit coursetaking seen in South Texas. At least one college in the region was involved in working with the Coordinating Board to ensure that dual credit legislation passed in 2003 included a means for students to quality to take technical and workforce education courses for dual credit. This model of providing opportunities for earning technical dual credit in workforce areas is different than the focus on articulated credit opportunities that are seen in other regions. An explanation for the number of students who take both was also provided in the interviews. A dual credit coordinator from this region stressed that encouraging students to take workforce education as well as academic dual credit allows students the opportunity to gain workforce skills that can be used to increase earnings while attending college, or serve as a fallback if a four-year college degree is not obtained.

College Outcomes and Coursetaking Patterns

For the 2004-2007 dual credit cohort, one year persistence in college and college freshman GPA differed by type of dual credit courses taken. The coursetaking data was also disaggregated by type of college enrollment (two-or four-year) for students in these categories.

As seen in Table 5.11, students taking only academic dual credit courses had a higher one-year persistence rate than students taking only non-academic dual credit courses. The persistence rates for academic coursetakers were higher at four-year institutions than at two-year institutions. Overall, 93.4 percent of academic dual credit coursetakers versus 86.8 percent of non-academic coursetakers persisted at four-year institutions, while 79.8 percent of academic coursetakers compared to 68.1 percent of non-academic coursetakers persisted at two-year institutions. The persistence rates for students taking both types of dual credit courses were quite similar to the rates for students taking only academic dual credit. Longitudinal trends over the four study years showed less variation in the one year persistence rates for academic-only coursetakers and students who took both types of courses than for students who took only non-academic dual credit courses, especially those who attend two-year colleges.

Student GPA is analyzed as a continuous measure in the ANOVA analysis presented later in this chapter. However, since the ANOVA does not look at year-to-year trends (and ANOVA tables show only least square means), average GPAs for the cohort students were grouped by year and type of course in Table 5.12.

Across group comparisons between the three types of dual credit coursetakers showed lower mean GPAs for students taking non-academic dual credit than for students taking academic dual credit or both types of course. Trends in the GPA data over

Table 5.11

One-Year Persistence of 2004-2007 High School Graduates who took Dual Credit Courses by Type of Course Taken and College Enrollment Type (Total Count 79,903)

Type of Dual Credit	Enroll-ment Type	Persist?	Year of High School Graduation 2004	2005	2006	2007	All Years
Academic	4 Year	Count →	10,747	11,913	12,723	14,468	49,851
		yes	93.6%	92.6%	93.6%	93.7%	93.4%
		no	6.4%	7.4%	6.4%	6.3%	6.6%
	2 Year	Count →	4,012	4,802	5,095	5,997	19,906
		yes	79.8%	79.2%	79.4%	80.7%	79.8%
		no	25.4%	26.3%	26.0%	24.0%	25.3%
Non-Academic	4 Year	Count →	345	415	518	786	2,064
		yes	87.8%	86.7%	88.0%	85.5%	86.8%
		no	12.2%	13.3%	12.0%	14.5%	13.2%
	2 Year	Count →	395	561	721	861	2,538
		yes	71.6%	67.4%	71.2%	64.5%	68.1%
		no	28.4%	32.6%	28.8%	35.5%	31.9%
Both	4 Year	Count →	723	782	977	1,373	3,855
		yes	91.1%	92.1%	92.4%	93.6%	92.5%
		no	8.9%	7.9%	7.6%	6.4%	7.5%
	2 Year	Count →	309	357	383	640	1,689
		yes	80.3%	79.3%	81.7%	79.4%	80.0%
		no	19.7%	20.7%	18.3%	20.6%	20.0%

Table 5.12

Mean Freshman GPA by Type of Course and HS Graduation Year

Type of Dual Credit	Year 2004	2005	2006	2007
Academic	2.804	2.765	2.755	2.732
Non Academic	2.496	2.442	2.398	2.294

time showed a steady decrease in GPA for all course types from 2004 to 2007. This decrease may simply be the result of increased participation but may also reflect efforts to include more middle-performing and at-risk students in dual credit programs.

The next two sections present data from the two Analysis of Variance (ANOVA) statistical analyses conducted using the dual credit cohort database.

ANOVA Results: All Dual Credit Courses Taken

An analysis of variance was conducted using the dual credit cohort database which contained records for 98,133 public high school graduates who took a total of 198,789 dual credit courses while enrolled in high school. (These are numbers of high school courses recorded in the PEIMS database since course types cannot be distinguished using THECB dual credit data). For every student in the cohort, the number of academic and non-academic courses taken was added to form a single continuous variable representing the level of each student's dual credit participation. The mean number of dual credit courses taken per student in the cohort was 2.026, with a standard deviation of 1.21.

The total number of dual credit courses taken served as the dependent variable in the ANOVA model. Eight independent variables were considered along with 10 selected two-way interactions. The independent variables were: type of courses taken (academic, non-academic, or both), gender, ethnicity, economic status, type of high school attended, region of high school attended, type of college enrollment, and persistence in the first year of college. The two-way interactions primarily addressed type of courses taken including type of courses by gender, by ethnicity, by economic status, by type of high school attended, by type of college enrollment and by one-year college persistence. Also included were gender by ethnicity, and economic status by ethnicity, by high school type, and by college type. The analysis included a Tukey-Kramer post hoc test to look for significant pairwise interactions within each independent variable group or grouping. Effect sizes were also explored using a partial omega squared statistic.

For the first ANOVA, which used the number of dual credit courses as the continuous variable, the range of courses was 1-14. The majority of student dual credit coursetaking levels fell at the lower end of the range, so the range was somewhat restricted. However, with almost 100,000 dual credit students included in the cohort, the population size provided an ample level of power to distinguish differences in coursework patterns. Only a few cells in each of the two ANOVA analyses had lower than 100 records. These cells represented subgroups of Native American students who, overall, made up a very small percentage of the dual credit coursetaking cohort. Two cells had a count of fewer than 10 students.

The results of the ANOVA for number of dual credit courses taken are shown in Tables 5.13 and 5.14. Table 5.13 provides information about the degrees of freedom, sum of squares, mean square, F statistic, and p-value for the model and each main effect and two-way interaction. Effect size is also shown on this table. For a more robust analysis of the full model, all of the calculations were done using Type III sum of squares. Table 5.14 presents the main effects groups with counts and descriptive data

Table 5.13

ANOVA - Number of Dual Credit Courses Taken

2004, 2005, 2006, and 2007 Texas Public High School Graduates

Model

	df	*Sum of Sq's*	*Mean Square*	*F*	*Pr>F*
Model*	56	24810.00	443.04	364.9	<.0001
Error	98,076	119076.14	1.21		

Effects

Source	*df*	*Type III Sum of Squares*	*Mean Square*	*F*	*Pr > F*	*ω 2*
Type of Course*	2	640.26	320.13	263.67	<.0001	0.0053
Gender*	1	12.64	12.64	10.41	0.0013	0.0001
Ethnicity*	4	21.67	5.42	4.46	0.0013	0.0001
Economic Status	1	0.45	0.45	0.37	0.5444	0.0
CB Region*	9	1895.65	210.63	173.48	<.0001	0.0156
High School Type*	2	137.12	68.56	56.47	<.0001	0.0011
Type of Enrollment*	2	127.50	63.75	52.51	<.0001	0.001
One-year Persist*	1	20.45	20.45	16.85	<.0001	0.0002
Course Type by Gender	2	9.41	4.71	3.88	0.0207	0.0001
Course Type by Ethnicity*	8	53.96	6.74	5.56	<.0001	0.0004
Course Type by Economic Status*	2	20.84	10.44	8.6	0.0002	0.0002
Course Type by HS Type*	4	130.11	32.53	26.79	<.0001	0.0011
Course Type by College Enr.*	4	87.93	21.98	18.11	<.0001	0.0007
Course Type by Persist*	2	13.24	6.62	5.45	0.0043	0.0001
Ethnicity by Gender	4	11.48	2.86	2.35	0.0516	0.0001
Ethnicity by Economic Status	4	3.19	0.80	0.66	0.622	0.0
Economic Status by HS Type	2	8.45	4.22	3.48	0.0308	0.0001
Economic Status by College Enr.*	2	26.80	13.40	11.03	<.0001	0.0002

* = significant at the .01 level

Table 5.14

Significant Differences for Number of Dual Credit Courses Taken

2004, 2005, 2006, and 2007 Texas Public High School Graduates who took Dual Credit Courses

Source	Groups	Count	LS Means	Standard Deviation	Tukey-Kramer Significant Differences
Model	All	98,133			
Type of Course*	Academic (A)	84,435	1.88	1.14	A> B
	Non-Academic (B)	7,094	1.24	0.61	
	Both (C)	6,604	3.18	1.46	C>AB
Gender*	Male (A)	40,335	2.05	1.22	
	Female (B)	57,798	2.14	1.20	B>A
Ethnicity*	Native American (A)	351	1.95	1.13	
	Asian (B)	3,570	2.19	1.21	
	African American (C)	4,875	2.05	1.11	
	Hispanic (D)	26,140	2.13	1.22	
	White (E)	63,197	2.16	1.21	E>C
Economic Status	Econ. Disadvantaged	19,395	2.11	1.22	
	Non Econ. Disadvataged	78,738	2.08	1.21	
Region*	High Plains (A)	7,825	2.38	1.39	A>BCDEFGHJ
	Northwest (B)	2,762	2.15	1.30	B>EFGJ
	Metroplex (C)	13,905	2.07	1.07	C>EFJ
	Upper East (D)	3,794	2.08	1.20	D> EFJ
	Southeast (E)	3,039	1.95	1.10	E>J
	Gulf Coast (F)	24,243	2.00	1.10	F>J
	Central (G)	9,369	2.02	1.18	G>J
	South Texas (H)	26,823	2.09	1.25	H>EFGJ
	West (I)	4,150	2.53	1.42	I>ABCDEFGHJ
	Upr. Rio Grande(J)	2,223	1.68	1.02	
High School Type*	Urban/Sub. High Ready (A)	23,647	1.92	0.94	
	Urban/Sub. Low Ready (B)	54,131	2.15	1.26	B>A
	Rural (C)	20,355	2.21	1.31	C>A
Type of Enrollment*	4 Year College (A)	55,770	2.18	1.27	A>BC
	2 Year College (B)	24,133	2.01	1.11	
	Unknown (C)	18,230	2.09	1.13	C>B
One-year Persist*	Did Persist (A)	70,895	2.14	1.24	A>B
	Did Not Persist (B)	27,238	2.05	1.13	

* = significant at the .01 level

included for each group. Significant differences identified using a Tukey-Kramer post hoc test are also shown on this table for all significant main effects. Least square means from the model are provided (in the following discussion of ANOVA results, when the term mean or means is used it refers to the least squares mean). Tables 5.15 through 5.20 and the figures that accompany four of them (Figures 5.1 to 5.5) show the significant differences for group pairings for all of the two-way interactions identified as significant in the ANOVA analysis of number of courses.

The ANOVA results show that the overall model for all courses taken was significant at the .01 level, a finding that supports the hypothesis that there are differences in the number of dual credit courses taken by the cohort population when several demographic and outcome measures are factored into the analysis. Significant main effects were found for type of courses taken, gender, ethnicity, type of high school attended, region, type of college enrollment, and one-year persistence, but were not found for economic status. Significant two-way interactions included course type by ethnicity, course type by economic status, course type by type of high school, course type by type of college enrollment, course type by college persistence and economic status by type of college enrollment.

Table 5.14 shows the Tukey-Kramer test results for significant differences for the independent variables studied. Details about significant findings for these variables will be discussed in terms of the two-way interactions studied except for region, which was not included in the two-way interactions. The Tukey-Kramer test for significant differences found differences between several regions in the mean number of courses taken with the Upper Rio Grande region showing the lowest mean number of courses taken by each student and the West and High Plains regions showing the highest. This aligns with the descriptive statistics for regional participation which showed the Upper Rio Grande valley having fewer overall dual credit coursetakers, proportionally, than most other regions, and the West and High Plains regions having a high number of coursetakers for their respective sizes. This suggests there may be a relationship between the proportion of dual credit participants in a region and the average number of dual credit courses that each participant completes.

The ANOVA results indicated that most regions were significantly different from their counterparts in terms of dual credit courses taken per student. It is interesting that several of the regions that did not have significantly different coursetaking means were adjacent geographically. For example, the Metroplex, Upper East and Northwest regions did not have significantly different mean numbers of courses taken, nor did the Gulf Coast and Southeast regions. The Central region was not different from the Northwest, Metroplex, or Gulf Coast. The high F-statistic for number of courses taken by region and the chi square results for type of course by region provide strong evidence that regional differences in dual credit coursetaking patterns were not attributable to chance.

Differences in Economic Status by Type of College Enrollment

The two-way interaction for economic status by type of enrollment was significant for the number of dual credit courses taken. The pairwise significant differences for this group, shown in Table 5.15 and Figure 5.1 on the following page, indicate that economically disadvantaged dual credit students whose enrollment was unknown took significantly fewer courses than disadvantaged students who attended four-year institutions. Economically disadvantaged students at four-year institutions took more dual credit courses in high school than economically disadvantaged students and non-economically disadvantaged students who attended two-year institutions. While no significant differences in the number of dual credit courses taken were found between the groups of economically disadvantaged students and not economically disadvantaged students who attended two year institutions, the mean number of dual credit courses taken was higher for economically disadvantaged students. The same can be said for students who attended four-year institutions.

ANOVA results for Type of Courses Taken

In the ANOVA model, all but one of the two-way interactions for type of courses taken (academic, non-academic, or both) were significant at the .01 level. The F-statistic for type of course was 263.67, the highest for any main effect or two-way interaction in the model. Students who took both academic and non-academic courses were likely to take more courses overall than students who took only academic or only non-academic courses. Given that at least two courses must be taken for a student to fit the "both" category, it was expected that coursetaking averages for the both category would be higher than for the academic or non-academic only categories. The mean for students taking both types was 3.18 courses per student.

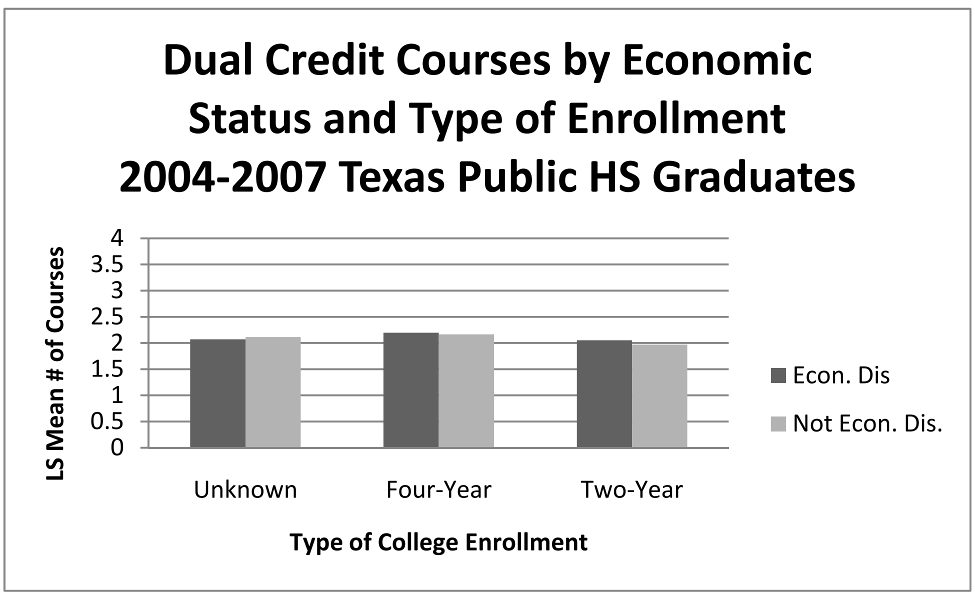
Table 5.15

Number of Dual Credit Courses Taken by Economic Status and Type of College Enrollment

Group	Count	LS Mean	Standard Deviation	Tukey-Kramer Significant Differences*
Econ. Dis./Unknown(A)	4,446	2.072	1.069	
Econ. Dis/Four-Year (B)	9,146	2.195	1.317	B>ACF
Econ. Dis./Two-Year (C)	5,803	2.053	1.137	
Not Econ. Dis/Unknown(D)	13,784	2.114	1.143	D>F
Not Econ. Dis./Four-Year (E)	46,624	2.165	1.257	E>F
Not Econ. Dis./ Two-Year (F)	18,330	1.97	1.095	
Total	98,133			

*p = < .01

Figure 5. 1



A breakdown of coursetaking patterns for students in the "both" category showed 56 percent of students took more academic than non-academic courses, 10 percent took the same number of each type, and 33 percent took more non-academic than academic courses. Students in the non-academic only course category took the fewest average number of courses (mean of 1.25) versus students taking academic courses (mean of 1.88). Although many of the high school courses most commonly taken for academic dual credit were one-unit courses (usually a full academic year in length), and most non-academic courses are one-half unit, students in the academic course only category still took more high school courses, on average, than students in the non-academic category.

The two-way interactions for type of course are presented in the next four tables and figures. The course type by ethnicity analysis (see Table 5.16/Figure 5.2 on the next page) showed that for students who only took academic dual credit courses, Asian and white students in the cohort took more courses, on average, than African American and Hispanic students. The mean number of academic courses taken by white students (1.92) was the same (when rounded) as the mean number taken by Asian students; similarly, the mean number of academic courses taken by African American students (1.78) was close to the mean number taken by Hispanic students (1.79). In terms of the number of courses taken by students who took only non-academic dual credit courses, the Tukey-Kramer test of significant differences found no differences in the average number of non-academic courses taken by ethnicity. For students who took both types of courses, the post hoc test established that there were differences between whites and African

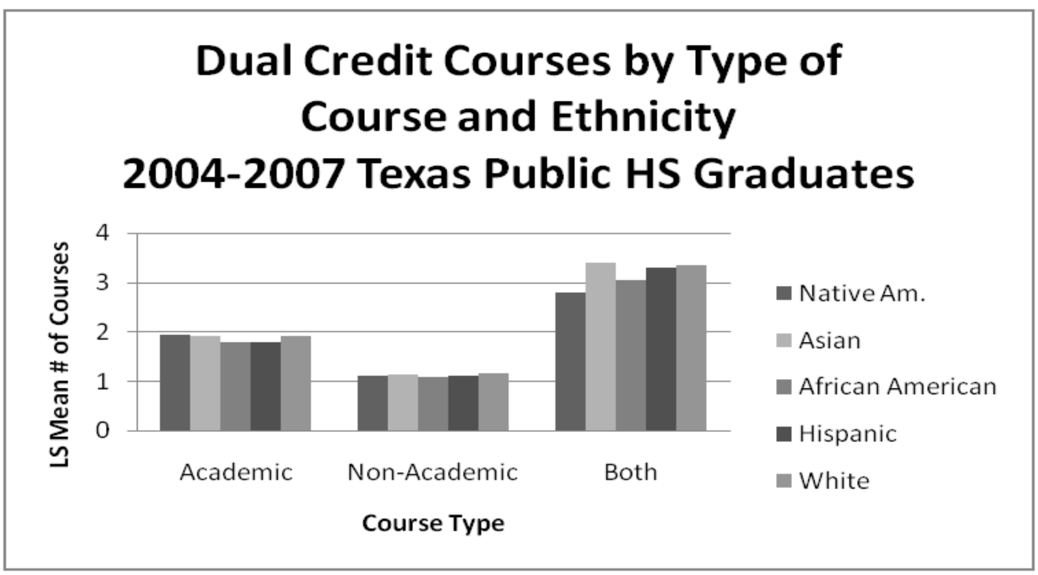
Table 5.16

Number of Dual Credit Courses Taken by Type of Course and Ethnicity

Group	Count	LS Mean	Standard Deviation	Tukey-Kramer Significant Differences*
Academic Only/Native American (A)	322	1.95	1.14	A>GHIJ
Academic Only/Asian (B)	3,193	1.92	1.14	B>CDGHIJ
Academic Only/African American (C)	3,926	1.78	1.07	C>GHIJ
Academic Only/Hispanic (D)	18,984	1.79	1.10	D>GHIJ
Academic Only/White (E)	58,010	1.92	1.15	E>CDGHIJ
Non-Academic Only/Nat. American (F)	14	1.11	0.36	
Non-Academic Only/Asian (G)	151	1.25	0.65	
Non-Academic Only/Afr.American (H)	642	1.30	0.57	
Non-Academic Only/Hispanic (I)	4,204	1.29	0.63	
Non-Academic Only/White (J)	2,083	1.23	0.58	
Both/ Native American (K)	15	2.80	0.83	K>FGHIJ
Both/ Asian (L)	226	3.40	1.47	L>ABCDEFGHIJ
Both/ African American (M)	307	3.05	1.33	M>ABCDEFGHIJ
Both/ Hispanic (N)	2,952	3.30	1.45	N>ABCDEFGHIJ
Both/ White (O)	3,104	3.34	1.48	O>ABCDEFGHIJM
Total	98,133			

*p =<.01

Figure 5.2



Americans, with white students taking more courses on average. No other interactions were found to be significant in the "both" category. Overall, the non-academic courses are more balanced by ethnicity in terms of the number of courses taken. The most notable differences for this interaction are seen across coursetaking types rather than within them.

The same is true for other significant two-way interactions involving course type. Table 5.17 and Figure 5.3 that follow show the analysis for type of course by type of high school district. The analysis indicated that students from urban/suburban high readiness (U/S HR) high schools (by district) took significantly fewer academic dual credit courses, on average, than students from rural and urban/suburban low readiness (U/S LR) schools, with a least square mean of 1.65 academic courses per student at the high readiness schools and 1.98 academic courses per student at both the low readiness and rural high schools. For students who took both types of dual credit courses, the type of high school was significant for all three high school types; students at the U/S HR schools took the lowest average number of courses per graduate and students at the rural schools took the highest. There were no significant differences in the mean number of non-academic courses taken by students among the three types of high schools.

The analysis of college enrollment by type of dual credit courses showed no significant difference in the number of dual credit courses taken by type of enrollment for students taking only non-academic courses. For students who took both course types, those who enrolled at two-year Texas colleges were more likely to take more dual credit courses than students who did not enroll or who enrolled at four-year colleges. For academic dual credit courses, students enrolling in four-year institutions took the most courses, on average, followed by students with an unknown enrollment status and then students attending two-year institutions. Significant differences were found across coursetaking types for all types of college enrollment. Table 5.18 and Figure 5.4 show the results for type of course by type of college enrollment.

The interaction for type of course by persistence was significant; significant differences across groups are shown in Table 5.19; however, because this persistence measure included the non-persistence status of all students with unknown enrollment as well as those who enrolled in a Texas higher education institution and did not persist, the data may not accurately reflect true persistence rates.

The pairwise differences involving economic status and type of courses taken are shown in Table 5.20 and Figure 5.5. In the course type analysis, no significant differences were seen in economic status within each coursetaking type. Economically disadvantaged students who took only academic dual credit courses took about the same number of courses as non-economically disadvantaged students; the same is true for students who took only non-academic courses and both types of courses. The differences were, instead, seen across levels and reflected the differences in course type addressed earlier. Given these results and the fact that economic status was not a significant main effect in the ANOVA ($F = .37$) or in two of the four two-way interactions involving economic status, it seems reasonable to suggest that economic status generally did not

Table 5.17
Number of Dual Credit Courses Taken by Type of Course and Type of High School District

Group	Count	LS Mean	Standard Deviation	Tukey-Kramer Significant Differences*
Academic Only/US HR (A)	21,983	1.65	0.893	A>DEF
Academic Only/US LR (B)	43,798	1.98	1.191	B>ADEF
Academic Only/Rural (C)	18,654	1.98	1.204	C>ADEF
Non-Academic Only/ US HR (D)	631	1.28	0.404	
Non-Academic Only/US HR (E)	5,969	1.25	0.629	
Non-Academic Only/Rural (F)	494	1.18	0.532	
Both /US HR (G)	1,033	2.83	1.034	G>ABCDEF
Both/ US LR (H)	4,364	3.23	1.414	H>ABCDEFG
Both /Rural (I)	1,207	3.47	1.795	I>ABCDEFGH
Total	98,133			

*p = <.01

Figure 5.3

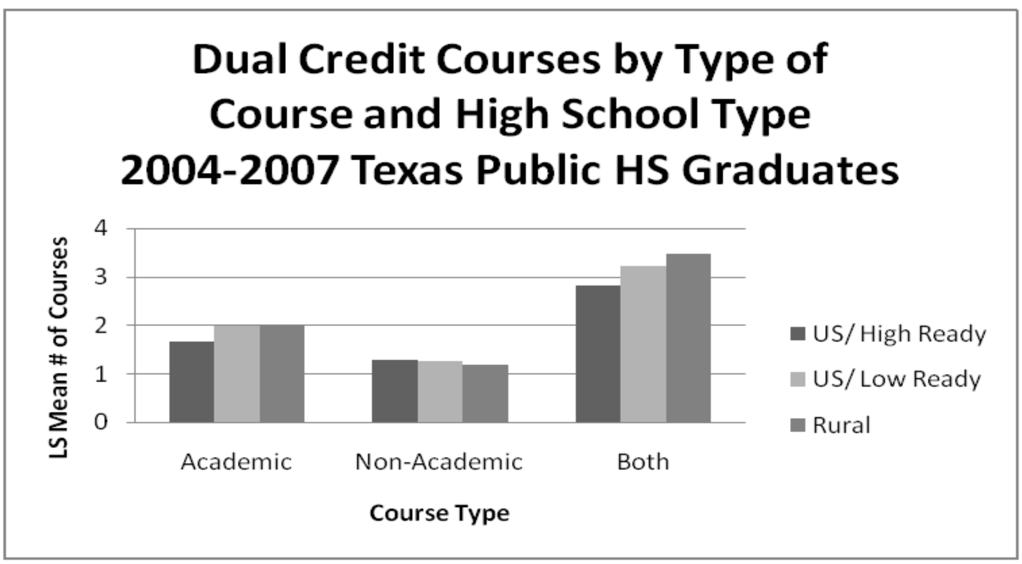


Table 5.18

Number of Dual Credit Courses Taken by Type of Course and Type of College Enrollment

Group	Count	LS Mean	Standard Deviation	Tukey-Kramer Significant Differences*
Academic Only/Unknown (A)	14,678	1.88	1.08	A>CDEF
Academic Only/Four-Year (B)	49,851	1.98	1.18	B>ACDEF
Academic Only/Two-Year (C)	19,906	1.76	1.04	C>DEF
Non-Academic Only/ Unknown(D)	2,492	1.21	0.58	
Non-Academic Only/Four-Y ear(E)	2,064	1.23	0.60	
Non-Academic Only/Two-Year (F)	2,538	1.27	0.63	
Both /Unknown (G)	1,060	3.20	1.35	G>ABCDEF
Both/ Four-Year(H)	3,855	3.33	1.52	H>ABCDEFI
Both /Two-Year (I)	1,689	3.00	1.35	I>ABCDEF
Total	98,133			

*p = <.01

Figure 5.4

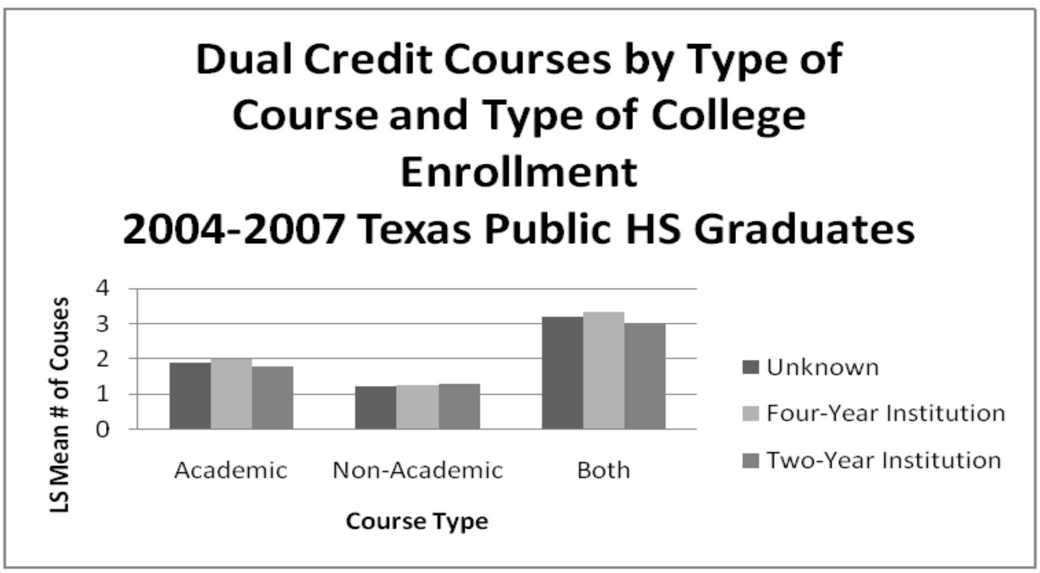


Table 5.19

Number of Dual Credit Courses Taken by Type of Course and One-Year College Persistence

Group	Count*	LS Mean	Standard Deviation	Tukey-Kramer Significant Differences*
Academic Only/No Persist(A)	21,979	1.81	1.08	A>CD
Academic Only/Persist (B)	62,456	1.93	1.15	B>ACD
Non-Academic Only/ No Persist (C)	3,574	1.24	0.60	
Non-Academic Only/Persist (D)	3,520	1.23	0.62	
Both /No Persist (E)	1,685	3.10	1.37	E>ABCD
Both/ Persist (F)	4,919	3.25	1.49	F>ABCD
Total	98,133			

*p = <.01

*Number of Courses by course type and persistence data include the full cohort of 2004-2007 Texas public high school graduates. See Table 5.8 for persistence rates by student (not number of courses taken) for the subpopulation of the cohort who attended Texas public and private institutions of higher education (students with unknown enrollments are included as non-persisters in this table).

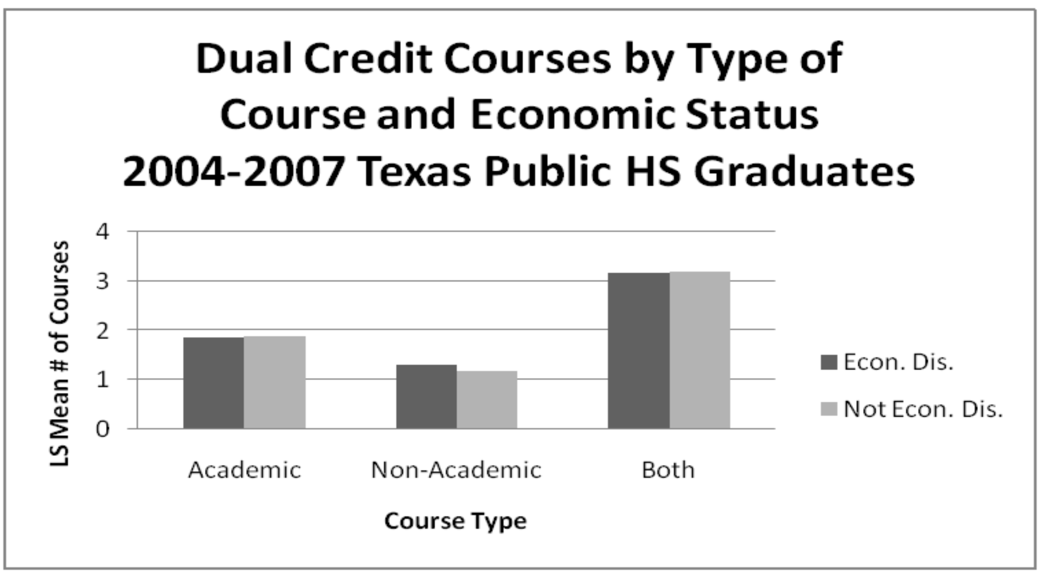
Table 5.20

Number of Dual Credit Courses Taken by Type of Course and Economic Status

Group	Count	LS Mean	Standard Deviation	Tukey-Kramer Significant Differences*
Academic Only/Econ. Dis (A)	13,486	1.86	1.11	A>CD
Academic Only/Not Econ. Dis. (B)	70,949	1.88	1.14	B>CD
Non-Academic Only/ Econ. Dis.(C)	3,596	1.30	0.64	
Non-Academic Only/Not Econ Dis. (D)	3,498	1.18	0.57	
Both /Econ Dis. (E)	2,313	3.16	1.44	E>ABCD
Both/ Not Econ. Dis. (F)	4,291	3.19	1.47	F>ABCD
Total	98,133			

*p = <.01

Figure 5.5



make a difference in the number of dual credit courses that students' took provided they took taking similar types of dual credit courses (academic only, non-academic only, or both).

Effect Sizes

The population of dual credit coursetakers examined in this study was large, and the range of possible courses taken limited to between 1 and 14 courses, of which the majority fell in the 1, 2, and 3 course range. Partial omega square analysis was run for all of the variables in the study using a w2 = df*(F-1) / (df*(F-1) +N) calculation. Type III sum of squares was used so that the full model was considered in the calculations. The overall effect sizes for the main effect and two-way interaction groups were quite small (see Table 5.13). The largest effect size is .02 for region, followed by .005 for type of course. For economic status and economic status by ethnicity, no effect size was found. The small effect sizes suggest that there might be little practical significance to the study of the number of dual credit courses taken. Clearly, the descriptive and qualitative data analyzed for this study provided a more comprehensive and robust picture of dual credit participation in Texas than did the statistical exploration of the number of courses students take. That said, there were some interesting findings about coursetaking patterns that provided a piece of the dual credit picture that was missing prior to the inquiry.

ANOVA Results for Grade Point Average

To answer research question four, an ANOVA was conducted to explore differences in college freshman GPA for students in the 2004 to 2007 high school graduation cohort who took dual credit while in high school. The analysis design mirrored the analysis of the number of dual credit courses taken: type of dual credit courses taken, gender, ethnicity, economic status, region, type of high school attended, type of college attended, and one-year persistence rates served as independent variables. The two-way interactions were also the same including type of courses taken and all of the independent variables except region, as well as gender by ethnicity, and economic status by ethnicity, high school type, and type of college enrollment. The full cohort of 2004 to 2007 high school graduates could not be used for the analysis of variance since college freshman GPAs were only available for 68,368 of the 98,133 students in the cohort. (GPAs are not collected from Texas private college attendees and were not available for students whose college attendance fell into the "unknown" category). The subset of high school graduates from the cohort who were followed in the GPA study will be referred to as the "dual credit GPA cohort." The results of the college freshman GPA analysis of variance are shown in Tables 5.21 and 5.22 (beginning on the next page).

The ANOVA using Type III sum of squares produced an F ratio of 177.74 for the model with significance at the .01 level ($p < .0001$). Some of the main effects groups showed significant differences by freshman GPA and some did not. Unlike the analysis for number of courses and type of course, the difference in average GPA for type of course was not significant with a p value of .553 and little variation across the least squared means. In addition to finding no significant differences in average GPA by type of courses taken, the analysis also detected no significant differences in average GPA when student economic status was considered. With an F statistic of 1.2 and a high p-value of .273, the lack of significance for average GPA by economic status was notable. On average, economically disadvantaged and non-disadvantaged students who took dual credit courses in high school appeared to perform at similar levels in college. The interaction of economic status by type of course was significant, but the differences were mainly seen across course types.

The results of the ANOVA showed significant differences in freshman GPAs (measured at the p .01 level) for some of the two-way interactions tested including course type by gender, ethnicity by gender, economic status by high school type and economic status by college type. The largest F value produced in the model was in the one-year persistence variable, with a least square mean GPA of 2.77 for students who persisted into the second year of college (90 percent of the dual credit GPA cohort) and 1.98 for students who did not. Since a low GPA can trigger a loss of eligibility for enrollment, the very large differences in GPAs for students who persisted and those who did not is not surprising.

Regional Differences

Examining within group interactions for GPA differences by region reveals that students from the Upper Rio Grande region had significantly higher least square mean GPAs than students from each of the other regions in the study except the Upper East. These two regions were among those with the lowest rates of dual credit participation compared to the all graduates cohort. The lower rate of participation could signal a more

Table 5.21

Analysis of Variance for College Freshman GPA

2004, 2005, 2006, and 2007 Texas Public High School Graduates who took Dual Credit Courses

Model

	df	*Sum of Sq's*	*Mean Square*	*F*	*Pr > F*
Model*	52	5936.31	114.16	177.74	<.0001
Error	68,315	43876.998	0.64		

Effects

Source	*df*	*Type III Sum of Squares*	*Mean Square*	*F*	*Pr > F*	*ω 2*
Type of Course	2	0.08	0.38	0.59	0.5532	0.0
Gender*	1	14.30	14.30	22.27	<.0001	0.0003
Ethnicity*	4	95.72	23.93	37.26	<.0001	0.0021
Economic Status	1	0.77	0.77	1.2	0.2725	0.0000
Region*	9	115.35	12.82	19.5	<.0001	0.0025
High School Type*	2	29.61	14.81	23.05	<.0001	0.0006
Type of Enrollment*	1	40.36	40.36	62.84	<.0001	0.0009
One-year Persist*	1	1335.66	1335.66	2079.57	<.0001	0.0295
Course Type by Gender*	2	9.75	4.88	7.59	0.0005	0.0002
Course Type by Ethnicity	8	9.03	1.13	1.76	0.0802	0.0001
Course Type by Econ. Status	2	0.61	0.31	0.48	0.6209	0.0000
Course Type by HS Type	4	4.93	1.23	1.92	0.1044	0.0001
Course Type by College Enrollment	2	2.42	1.21	1.88	0.1524	0.0000
Course Type by Persist	2	4.30	2.15	3.35	0.0351	0.0001
Ethnicity by Gender*	4	18.16	4.54	7.07	<.0001	0.0004
Ethnicity by Economic Status	4	7.96	1.99	3.1	0.0146	0.0001
Econ. Status by High School Type*	2	7.08	3.54	5.51	0.0041	0.0001
Econ. Status by College Type*	1	34.06	34.06	53.03	<.0001	0.0008

* = significant at the .01 level

Table 5.22

Significant Differences for Freshman Year GPA

2004, 2005, 2006, and 2007 Texas Public High School Graduates who took Dual Credit Courses

Source	Groups	Count	LS Means	Standard Deviation	Tukey-Kramer Significant Differences
Model	All	68,368			
Type of Course	Academic	59,583	2.41	0.84	
	Non-Academic	3,926	2.34	0.92	
	Both	4,859	2.37	0.87	
Gender*	Male (A)	27,678	2.31	0.87	
	Female (B)	40,690	2.43	0.84	B>A
Ethnicity*	Native American (A)	209	2.56	0.90	
	Asian (B)	2,763	2.49	0.80	B>CD
	African American (C)	3,146	2.17	0.88	
	Hispanic (D)	18,039	2.23	0.88	
	White (E)	44,211	2.41	0.82	
Economic Status	Econ. Disadvantaged	13,018	2.35	0.89	
	Non Econ. Disadvantaged	55,350	2.39	0.84	
Region*	High Plains (A)	5,420	2.40	0.89	A>CEFG
	Northwest (B)	1,885	2.37	0.86	
	Metroplex (C)	9,126	2.31	0.83	
	Upper East (D)	2,537	2.41	0.85	D>CEFG
	Southeast (E)	2,306	2.31	0.87	
	Gulf Coast (F)	17,378	2.30	0.83	
	Central (G)	6,597	2.32	0.84	
	South Texas (H)	18,547	2.37	0.87	H>CGJ
	West (I)	3,062	2.41	0.86	I>CFG
	Upr. Rio Grande (J)	1,510	2.51	0.86	J>ABCEFGHI
High School Type*	Urban/Sub. High Ready (A)	15,946	2.47	0.79	A>BC
	Urban/Sub. Low Ready (B)	37,534	2.35	0.86	
	Rural (C)	14,888	2.29	0.87	
Type of Enrollment*	4 Year College (A)	45,994	2.32	0.84	
	2 Year College (B)	22,374	2.42	0.87	B>A
One-year Persist*	Did Persist (A)	61,483	2.77	0.79	A>B
	Did Not Persist (B)	6,885	1.98	1.04	

* = significant at the .01 level

selective approach to allowing students to take dual credit courses which may, in turn, have an impact on college freshman GPA. Significant differences for all regions for freshman GPA are shown in Table 5.22.

Tukey-Kramer Significant Pairwise Differences

Significant group differences for gender and ethnicity were found for several groups (see Table 5.23, Figure 5.6). While the mean college freshman GPA was higher for females than males in every ethnicity, the differences were significant for African American, Hispanic, and whites and not for Asians and Native Americans. However, differences in population sizes may be responsible for the lack of significance differences for the latter two groups. The difference between mean Hispanic female and Hispanic male GPA (2.26 versus 2.21, respectively) was less than for Asian females and males (2.54 versus 2.43). The difference for whites, the largest population in the study, was 2.47 versus 2.34. This difference was significant at the .01 level with a p value of <.0001. The difference in least square means between Native American females and males, 2.67 to 2.45 respectively, was larger than any of the other differences but was not significant; the Native American population was very small (209 individuals).

The analysis of course type and gender showed significant group differences between female and male college freshman GPAs for students taking only academic dual credit courses and students taking both types of courses (see Table 5.24 on page 234). Significant differences were not found for students taking non-academic courses, a group

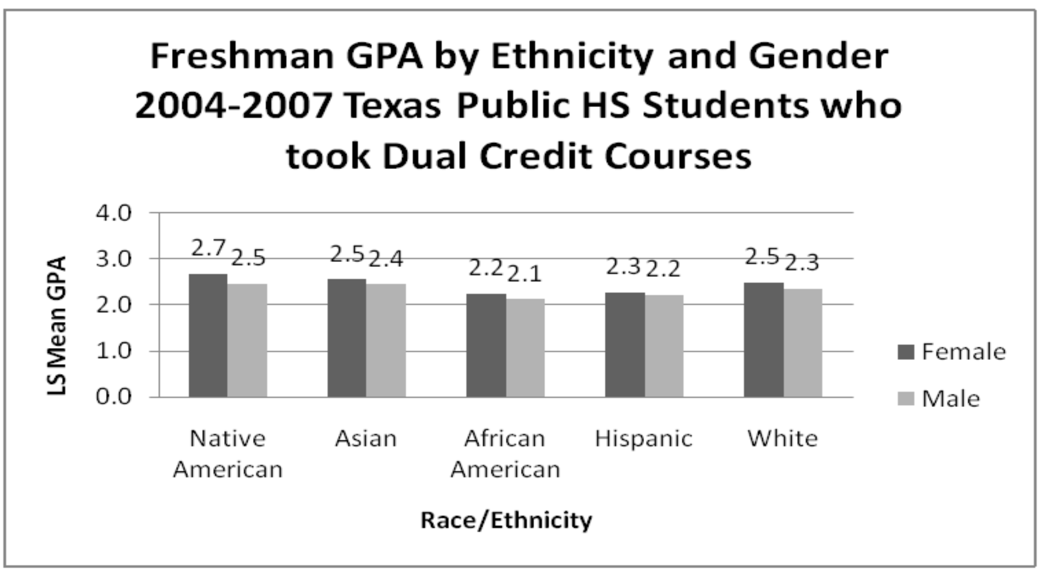
Table 5.23

Freshman Grade Point Average (GPA) by Ethnicity and Gender

Group	Count	LS Mean GPA	Standard Deviation	Tukey-Kramer Significant Differences*
Native American/Female (A)	120	2.67	0.86	
Native American/Male (B)	89	2.45	0.94	
Asian/Female (C)	1,523	2.54	0.79	C>EFGHJ
Asian/Male (D)	1,240	2.43	0.82	D>EFGH
African American/Female (E)	2,191	2.23	0.87	E>F
African American/Male (F)	955	2.11	0.90	
Hispanic/ Female (G)	10,987	2.26	0.87	G>FH
Hispanic/ Male (H)	7,052	2.21	0.90	
White/Female (I)	25,869	2.47	0.80	I>EFGHJ
White/Male (J)	18,342	2.34	0.84	J>FGH
Total	68,368			

*p =< .01

Figure 5.6



for which the male and female *N*s are more similar. As in the gender and ethnicity study, females had higher least squares mean GPAs than males in all three coursetaking categories.

Results for average college freshman GPA by economic status and type of high school (Table 5.25, Figure 5.7) indicate that economically disadvantaged students from urban/suburban high readiness (U/S HR) high schools (determined by district) who took only academic dual credit courses had higher mean GPAs than economically disadvantaged students from urban/suburban low readiness (U/S LR) high schools. This group also had higher mean GPAs than non-economically disadvantaged students from rural high schools. No significant differences were found between economically disadvantaged students from U/S LR high schools and rural high schools. The non-economically disadvantaged students from U/S HR high schools had significantly higher mean GPAs than all economic status groups from LR/US and rural high schools but did not have significantly different mean freshman GPAs than their economically disadvantaged counterparts from the same school type (U/S HR). However, what is important to note here is that the number economically disadvantaged students at U/S HR high schools who took dual credit courses was very low compared to the number of low-income participants at U/S LR and rural schools. A total of 1,155 dual credit students in the GPA cohort who attended U/S HR schools were economically disadvantaged compared to 9,576 at U/S LR schools and 2,287 at rural schools (see table 5.4 for a breakdown of economic status for the entire dual credit cohort). While this is probably,

Table 5.24

Freshman Grade Point Average (GPA) by Course Type and Gender

Group	Count	LS Mean GPA	Standard Deviation	Tukey-Kramer Significant Differences*
Academic Only/Female (A)	35,668	2.49	0.83	A>B
Academic Only/Male (B)	23,915	2.32	0.86	
Non-Academic Only/ Female (C)	2,076	2.38	0.92	
Non-Academic Only/Male (D)	1,850	2.30	0.92	
Both /Female (E)	2,946	2.43	0.84	E>F
Both/ Male (F)	1,913	2.31	0.89	
Total	68,368			

*p = <.01

Figure 5.7

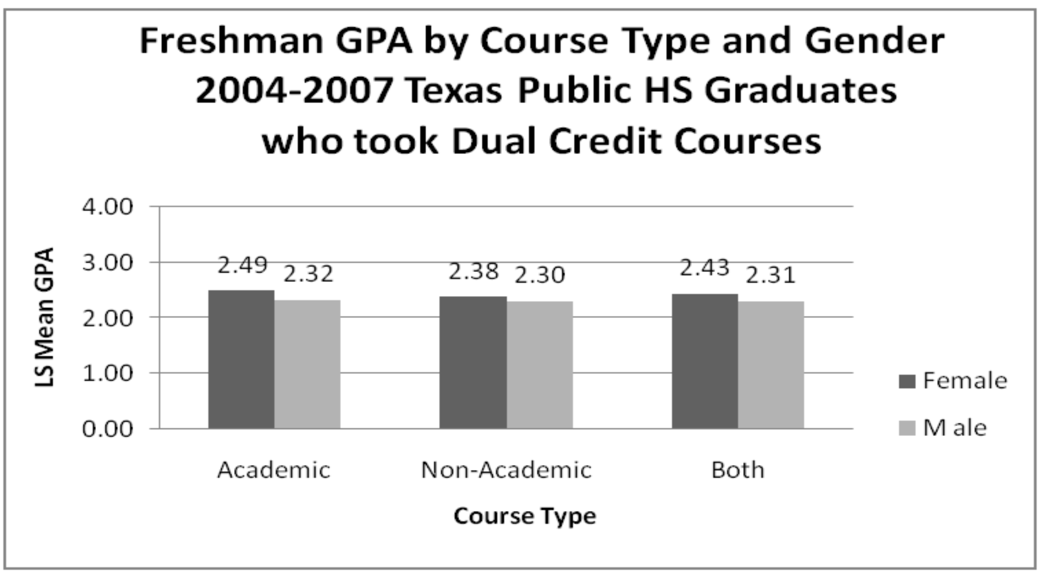
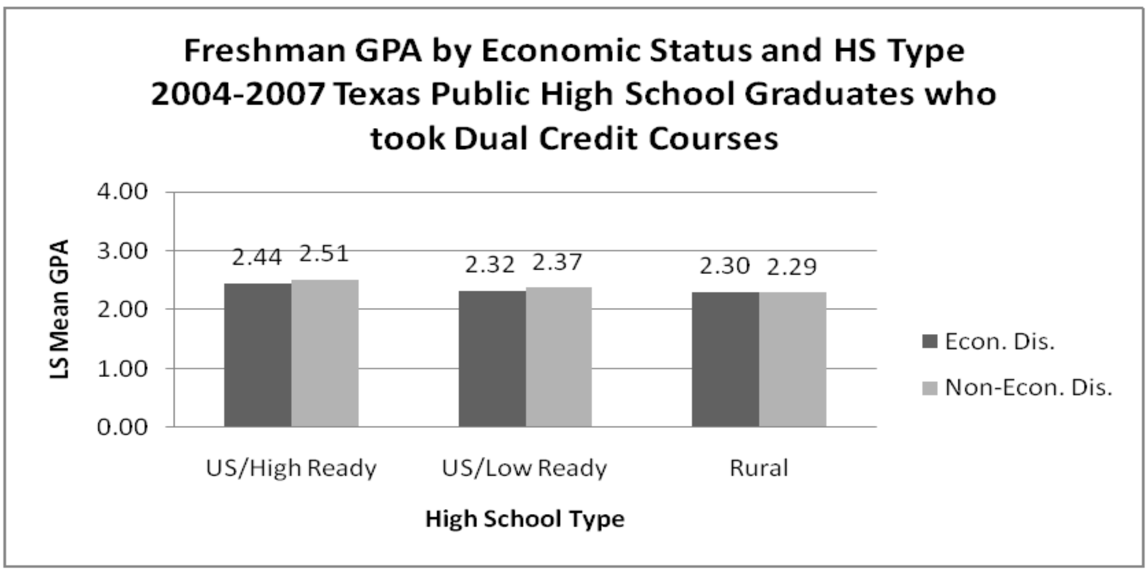


Table 5.25
Grade Point Average (GPA) by Economic Status and Type of High School

Group	Count	LS Mean GPA	Standard Deviation	Tukey- Kramer Significant Differences*
Econ. Dis./Urban Sub. HR (A)	1,155	2.44	0.84	A>BCF
Econ. Dis/Urban Sub. LR (B)	9,576	2.32	0.90	
Econ. Dis./Rural (C)	2,287	2.30	0.90	
Not Econ. Dis/Urban Sub. HR (D)	14,791	2.51	0.79	D>BCEF
Not Econ. Dis./Urban Sub. LR (E)	27,958	2.37	0.84	E>F
Not Econ. Dis./ Rural (F)	12,601	2.29	0.86	
Total	68,368			

*p= <.01

Figure 5.8



in part, a function of the overall population breakdown by economic status for U/S HR schools, it may have to do with how students are selected for dual credit in these districts. Interview results revealed that while some districts reach out to at-risk, middle-performing, and traditionally under-represented students for dual credit and Early College High School opportunities, others do not.

Results for economic status by type of college enrollment (Table 5.26, Figure 5.9) showed group differences in freshman GPA for students who enrolled at four-year public institutions and those who enrolled at two-year public institutions. Students from two-year colleges had higher least squares mean GPAs than students who enrolled in four-year institutions.

There were no significant differences in mean GPA between economically disadvantaged and non-disadvantaged students who attended four-year institutions; the same was true for economically disadvantaged and non-disadvantaged students who attended two-year institutions. These results mirror other results from this study related to economic status which showed that students from different economic backgrounds who attended the same types of institutions looked similar on certain measures. Some differences in this two-way interaction (economic status by type of enrollment) were seen across types of institutions. For example, economically disadvantaged students at two-year colleges had significantly higher mean GPAs than economically disadvantaged counterparts at four year colleges.

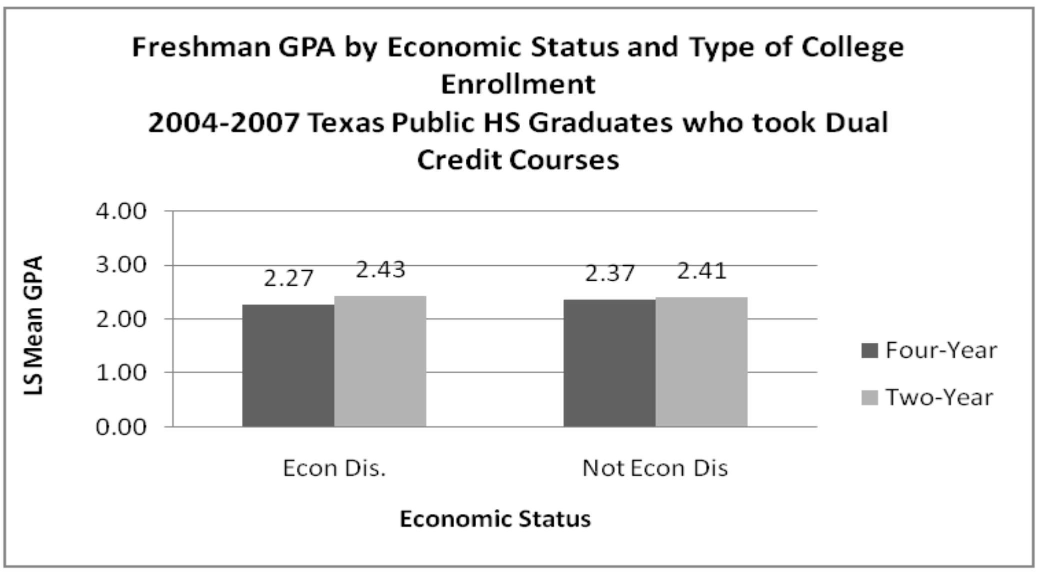
Table 5.26

Freshman Grade Point Average (GPA) by Economic Status and Type of College Enrollment

Group	Count	LS Mean GPA	Standard Deviation	Significant Differences*
Econ Dis/Four-Year (A)	7,751	2.27	0.89	
Econ Dis/Two-Year (B)	5,267	2.43	0.91	B>A
Not Econ Dis/Four-Year (C)	38,243	2.37	0.82	
Not Econ Dis/Two-Year (D)	17,107	2.41	0.86	D>A
Total	68,368			

*p= <.01

Figure 5.9



Effect Sizes in the GPA Model

Effect sizes calculated for the GPA model are provided in Table 5.21. The effect size calculation indicated that the amount of variation attributable to the variables studied was small, as were the effect sizes for the model for dual credit courses taken. One year persistence rates by GPA accounted for the most variability at .03 percent, followed by regional differences at .0025 percent.

The results of the ANOVA analysis showed that there were differences in the number of dual credit courses taken and freshman GPAs for students in the 2004-2007 graduate dual credit cohort. While several main effects and interactions were significant, effect sizes led to questions about the practical significance of this model.

Summary

Some useful information was gleaned from the two analysis of variance studies. While small effect sizes made it difficult to gauge the practical significance of the model, and the ranges for the continuous variables were somewhat restricted, there were patterns of differences that were worth noting, primarily for the interactions that considered the number of courses taken by type of courses taken (academic only, non- academic only, or both). As seen in Figures 5.2 (course type by ethnicity) 5.3 (course type by high school type), 5.4 (course type by college type), and particularly in Figure 5.5 (course type by economic status), the bar graphs show that there was much more difference across course types than within course types. For 2004-2007 Texas public high school graduates who took dual credit courses while in high school, differences in the number of courses taken (level of participation) had a lot to do with the type of course and not the demographic variables studied.

CHAPTER SIX: DISCUSSION

Policy makers are increasingly focused on the need to adopt more comprehensive approaches to educational reform. Many believe that a P-16, or preschool through college, approach provides an excellent framework for enhancing alignment and, as a result, improving educational outcomes both within and across educational systems. One area of P-16 reform that has received significant attention is the high school to college transition. K-12 and higher education systems often have different structures, cultures, and priorities. Programs to improve student readiness for and success in college must cross the institutional gaps between secondary and postsecondary education. Misalignments hinder both student and institutional success.

One fast-growing initiative straddles the high school to college divide in myriad ways. Dual credit programs offer high school students the opportunity to enroll in college-level courses and earn both high school and college credit for their efforts. Traditionally, these programs have provided high achieving high school students access to challenging college material and a means to avoid duplication of courses offered at both levels. Increasingly, however, dual credit opportunities are offered not only to the highest achievers, but also to middle-achieving and at-risk students. "When properly designed, it [dual credit] can serve as on 'on ramp' to postsecondary education for students otherwise unlikely to attend college" (Hoffman, Vargas, and Santos, 2008, p. 2).

In Texas, dual credit programs are primarily offered through public community colleges, although public universities and private higher education institutions also offer dual credit opportunities. Dual credit programs are locally developed and administered, but public high schools and colleges must follow guidelines set by the state K-12 and higher education agencies, which in Texas are the Texas Education Agency (TEA) and the Texas Higher Education Coordinating Board (THECB).

Overview of Study and Chapter Organization

This analysis was prompted by rapid growth in dual credit program participation in Texas. The exponential growth of program populations highlighted a need for a better and more comprehensive understanding of dual credit data, programs, and populations. The study looks at dual credit from a state-wide perspective but uses a P-16 approach. P-16 innovators and policy makers often work within the overlapping spheres of state, local, K-12, and postsecondary education. Because of the interconnected nature of dual credit data, policy, and practice, the researcher integrated data and information from across each of these four spheres into the study. The matrix below provides a visual illustration of how the sectors and levels inter-relate.

P-16 Spheres that Influence Dual Credit	State-Level Context	Local and Regional-Level Context
Higher Education Sector	State-Level Higher Education (THECB)	Local and Regional Higher Education (Public and Private Colleges & Universities)
K-12 Education Sector	State-Level K-12 Education (TEA)	Regional and Local K-12 (School Districts, High Schools)

Several methods were used to collect data for the study. Comparisons of state-level data looked at inconsistencies in dual credit reporting across the THECB and TEA databases. Local-level feedback from interviews with dual credit coordinators at both the K-12 and Higher Education levels helped to clarify, affirm, or disprove information gleaned from the state-level data. A review of dual credit agreements between local and regional K-12 and higher education partners as well as an analysis of dual credit course "crosswalks" provided additional insight into dual credit data and coursetaking patterns. Finally, a research data file consisting of demographic and freshman college outcome data was compiled using information learned from the mixed-method explorations. Characteristics of Texas public high school students who graduated from 2004 to 2007 and who took one or more dual credit course(s) at a Texas public college or university while enrolled in high school were explored using descriptive and inferential data analysis. A file of all students who graduated from a Texas public high school from 2004 to 2007 was created for comparison purposes.

All of these research activities were employed to examine dual credit student populations, data alignment, and coursework patterns in Texas. The discussion of results in this chapter is organized under four broad headings: State Dual Credit Populations and Data Alignment Issues; Dual Credit Crosswalks and Local Issues; Secondary and Post-Secondary Alignment Issues; and Balancing Dual Credit Tensions. Each of the major sections includes recommendations for policy and practice. The chapter concludes with ideas for future research and some final observations.

State Dual Credit Populations and Alignment Issues

Current literature on dual credit programs stresses the importance of obtaining better data for tracking dual credit students and for gauging the effectiveness of dual credit programs. While dual credit programs are growing rapidly, few states have a means to follow student performance in dual credit across the high school/college transition. A recent study of dual credit participation in Florida (Karp et al., 2007) was possible because Florida has an extensive and aligned P-20 data resource. While Texas has excellent data collection systems and the capacity to track students from high school to college, the dual credit data available in the systems is limited and not well-aligned.

Cross Data-Base Comparison

Understanding differences in dual credit data across TEA and THECB databases was an important objective of this study. To help achieve this goal, enrollment records were compared for all Texas public high school students enrolled in the 2006-2007 academic year and all Texas public college enrollments for this same period. All students with dual credit hours in the THECB higher education system database were extracted, as were all students in the TEA K-12 database who were reported as taking one or more dual credit course(s). In addition, any student who was enrolled in both systems during the 2006-2007 academic year was followed, even if dual credit participation was not reported in either system.

Several aspects of this study highlight the difficulties of trying to align data that is reported to two different systems using two different formats. The results of the comparison showed that a high number (26 percent) of students who were reported with dual credit courses by TEA were not enrolled in, or reported with dual credit hours by, a Texas public higher education institution. In addition, a large portion of the public high school enrollees who were reported with dual credit hours in the THECB system were not reported with dual credit courses in the TEA system (29 percent). Several reasons for these differences were discovered through the interview and document review component of the study. Dual credit coordinators provided helpful information about how dual credit data is reported to state agencies from school districts and higher education institutions.

Problems with Concurrent Enrollment Data

The study results stressed the importance of understanding practice in the development of data collection processes. Concurrent enrollment data is a good example. While the THECB system has the capacity, when used in conjunction with TEA records, to distinguish dual credit course hours (taken by high school students for high school and college credit) from concurrent enrollment course hours (taken by high school students for college credit only), practitioners in the field often either did not understand how THECB defined dual credit versus concurrent enrollment students, or they were unable to differentiate and properly report these students. Thus, large numbers of students reported as attempting dual credit hours in the THECB system actually attempted concurrent enrollment hours.

THECB rules limit the number of dual credit courses most students may take to two courses a semester. These rules reflect appropriate concern by policy-makers about student course loads. Given the high levels of concurrent enrollments, policy-makers should also be concerned about the number of concurrent enrollment hours a high school student attempts during the school year. The limitations and guidelines for participation that apply to dual credit students should be applied concurrent enrollment students.

Finding a way to ensure that concurrent enrollment courses are accurately reported is important for research and policy-making. The THECB should provide better training and information about how to report students using the current system, and consider adding a data element to clearly identify concurrent enrollment high school students.

Other State-Level Data Alignment Issues

State-level guidelines are designed to provide a measure of consistency for dual credit programs. But reporting practices and guidelines contain inconsistencies that sometimes impair accurate data-collection efforts. For example, TEA and THECB guidelines differ on whether credit hours must be attempted simultaneously at the high school and college level for a course to qualify as dual credit. In addition, school districts do not report summer course data to TEA; therefore, summer enrollments cannot be compared across databases to confirm the accuracy of summer dual credit reporting. As a result, summer dual credit coursework patterns cannot be tracked at the state level.

Another issue of concern results from the fact that each education agency has data collection authority only over the institutions it is charged with monitoring. It is critical for TEA and THECB to collaborate to achieve alignment in dual credit definitions and data collection practices. Without consistent reporting guidelines, data will be misinterpreted and decisions will be based on faulty interpretations.

An unanticipated finding in this research project involved Advanced Placement (AP) courses. The data revealed large numbers of dual credit courses linked to Advanced Placement (AP) course codes. The initial assessment of this problem was interpreted by the researcher as high schools misreporting AP courses as dual credit courses. However, the opposite proved to be the case, based on interviews and document analysis. According to dual credit coordinators, AP course content frequently aligns better to dual credit college courses than does traditional high school course content. Unfortunately, the common practice of linking AP course codes with dual credit courses causes state-level AP data to be compromised and makes it difficult to study differences between the two types of programs.

Rather than drop the AP courses reported as dual credit from the analysis (which would have been a logical response to misreported AP courses), those courses were included in the analysis because evidence suggested they were, in the majority of cases, dual credit courses or dual credit/AP overlay courses. Without the additional insight provided by triangulating sources, a very different set of records may have been used for the descriptive and inferential data analysis in this study.

Private Education and Public Education Overlap

Although there is significant overlap, the dual credit populations tracked in the TEA and THECB data systems are not the same. Public high school students take dual credit courses at private and out-of state institutions and private and home-schooled students take dual credit courses at public colleges. Efforts to align dual credit courses and data across the public high school and public college curriculum must accommodate these population differences. Dual credit serves an important purpose for home-schooled and private school students who may not otherwise have access to the course content and instructor expertise available through these programs. A means to identify if a high school student is home schooled, attends private school, or attends public school would be a valuable addition to the higher education data collection system. Likewise, a means to identify if a public high school student took a particular dual credit course at a public, private, or out-of-state college would enhance understanding of public high school students' dual credit activities.

Dual Credit Populations in Texas

Wide-ranging data about approximately 100,000 Texas dual credit participants were disaggregated and analyzed to gain knowledge of dual credit populations and coursetaking patterns in Texas. Trends over time were studied as were differences across subpopulations.

Data File Construction

The data file for 2004 to 2007 high school graduates who took dual credit courses while in high school provided the input for several descriptive and inferential analyses conducted for this study. After careful consideration of the nature of the data inconsistencies identified across the TEA and THECB reporting systems, only students who were reported with at least one dual credit course in the TEA system and one dual credit hour in the THECB system in the four years prior to their high school graduation were included in the cohort. This decision greatly increased the likelihood that all of the cohort students took at least one dual credit course while in high school, but excluded students who were not enrolled in public educational institutions at both levels. Of the two state-level data systems, only the TEA data base includes course records that can be used to specify the number and type of dual credit courses completed. Therefore, all of the student-in-course level records in the analyses were derived from TEA data.

Descriptive longitudinal data about students in the cohort were organized by year of high school graduation (2004, 2005, 2006, or 2007) and incorporated several demographic and outcomes variables. These included type of dual credit courses taken, gender, race, economic status, type of high school attended, region, type of college enrollment, persistence in the first year of college and college freshman GPA range. The analysis highlighted both single and two-way interactions, including several that focused on students who took academic dual credit courses, non-academic dual credit courses, or both.

Demographic Differences

Gender differences in dual credit participation were associated with several variables. The study found that males took dual credit courses at lower rates than females. This finding is of concern because males continue to fall behind females in many aspects of college readiness and success. Although men took academic dual credit courses at lower rates than female students, they were equally represented in non-academic dual credit course participation. Importantly, this fact suggests that "non-academic" coursework, including technical courses, may be a means to engage more young men in post-secondary educational pursuits.

The data in this study showed that while dual credit enrollments in Texas still favor traditional college-bound students, participation by underrepresented minority and low-income students is growing. Expanded participation has the potential to increase the college success rates of Hispanic, African American, and low income students by providing them with opportunities to take more rigorous coursework, enhance their understanding of the college experience, and gain confidence in their ability to succeed. The increased participation is due, in part, to the growth of early college high schools in Texas, most of which target at-risk populations. It also reflects increased efforts on the part of many high schools and colleges to engage non-traditional students in dual credit programs. The financial benefits from low or no cost dual credit courses are an economic incentive for many to continue their education past high school.

Results show that dual credit participation at rural school districts is proportionally very high. This confirms that dual credit courses provide opportunities for rural students who have traditionally had limited access to accelerated programs because of the small size of their schools.

Analyses of Coursetaking Frequencies and College Freshman GPA

An analysis of variance (ANOVA) study was conducted to investigate differences in the number of dual credit courses taken by students in the cohort by type of dual credit courses taken, gender, race, economic status, type of high school attended, region, type of college enrollment, and persistence in the first year of college. An additional ANOVA examined college freshman GPA as a continuous dependent variable by the independent variables listed above. The results of both ANOVAs showed significant differences in the cohort population in several of the measures studied. Several two-way interactions were included in the model, primarily to look more closely at pairwise differences by economic status and type of courses taken.

Academic and Non-Academic Coursetaking

As efforts to reach students who are not traditionally represented in college have grown, there is interest in learning more about not only the types of students who participate in dual credit programs, but also the type of coursework these students are attempting. While still a small percentage of the dual credit population, the number of students taking only non-academic courses or taking both academic and non-academic courses is growing at a fast pace. In fact, the number of students taking only non-academic courses doubled from 2004 to 2007 with the percentage of students who took only non- academic courses during high school growing steadily from 5.8 percent of the dual credit coursetaking population in 2004 to 8.6 percent in 2007. The percentage of academic only coursetakers dropped from 88.0 percent to 83.3 percent during this same period. This trend indicates a change in the nature of dual credit participation that should be carefully monitored.

Differences in race and ethnicity were also explored by type of courses taken. Hispanic and African American student participation rates were much higher for students who took only non-academic courses than for those who took academic courses exclusively, and Hispanic participation rates approximated those of whites for the population that took both academic and non-academic courses.

Non-Academic Coursetaking at Early College High Schools

Early college high schools are committed to exposing students to college-level courses but also to giving them a window into other aspects of college culture and expectations. Often these schools place high school freshmen and sophomores into courses that would fit the "non-academic" category in this study. Early college high school students who have not met state academic requirements for dual credit participation have an opportunity for early exposure to the college environment by taking fine arts, physical education, foreign language, or technical/workforce courses for which requirements are less stringent. This may explain the statewide increase in non-academic coursetaking observed in the data. Unfortunately, the THECB data system has no means to identify and track early college high school students, and TEA data files cannot be used to identify students as early college high school attendees unless they attend campuses with a unique campus code. This means of record keeping excludes the many early college high school students who attend schools which are part of traditional high school campuses. TEA is aware of this problem and is considering remedies.

Regional Differences in Coursetaking Types

Study results indicated significant regional differences in types of coursetaking. Of these, the regional differences in non-academic coursetaking were most notable. For example, approximately half of all of the students taking non-academic dual credit courses were from the South Texas region of the state.

Policies about the provision of college-level technical and workforce education courses vary across institutions. Some high school and college partnerships emphasize articulated credit programs; others choose to offer technical and workforce education courses as dual credit opportunities. While articulated credit programs generally allow any interested high school student to enroll, articulated course credits are not awarded until a student enters the partner college and meets additional requirements. Students must meet state-level eligibility requirements to enroll in technical or workforce dual credit courses, but the student has the advantage of earning high school and college credit simultaneously.

Loopholes and lack of clarity in THECB rules pertaining to some workforce and technical programs have resulted in significantly different local policies about who is allowed to take “non-academic” dual credit courses. Few efforts have been made at the state level to monitor technical, workforce, and other non-academic dual credit opportunities. And while articulated and dual credit programs have traditionally been kept separate, it is time for state and local stakeholders to look at the advantages, disadvantages of both programs including how they are implemented and what structures, rules, and regulations are in the best interests of the students and institutions that participate.

Economic Status and Coursetaking Types

One of the most surprising results of the study was the lack of significance of the economic status variable in many of the interactions. While the descriptive data showed that economically disadvantaged students were less likely than other students to take dual credit courses, the ANOVA results showed that disadvantaged students who did take dual credit courses took a similar number of courses as non-economically disadvantaged students when disaggregated by course type.

No significant differences in economic status were found in college freshman GPA when considered by course type (academic, non-academic, or both). The mean college freshman GPA for disadvantaged students who took dual credit in high school and enrolled at a four-year Texas public higher education institution was similar to the mean GPA for other students who enrolled in four-year institutions.

College Outcomes

The study also focused on first-year college performance outcomes for dual credit students. Other studies indicate that college outcomes for Texas public high school students who take college-level courses tend to be better than for students who don't (see for example THECB, June, 2008; Hargrove, Godin, & Dodd, 2008). Dual credit students in the 2004-2007 graduation cohort enrolled in two-year colleges at higher rates, enrolled in four-year institutions at higher rates, and were more likely to persist to the second year of college than the general population of first-time-in-college students in Texas. While impressive, these outcomes must be understood in the context of state rules for dual credit participation. Only students who meet set academic standards on eligible tests are allowed to enroll in dual credit courses. Therefore, these outcomes cannot be causally linked to dual credit participation.

Within the dual credit cohort, there are differences in college enrollment and persistence rates by subpopulation, but they tend to be small. Thus, while dual credit participation rates were lower for underrepresented students, this group enrolled in four year institutions at similar rates to their traditional college-going counterparts, and they had similar one-year persistence rates. The differences were even less notable when outcomes were disaggregated by type of courses taken.

Opportunity to Participate

Comprehensive and accurate state-level information about participation in dual credit programs becomes particularly important as the focus of programs turns from the highest performing students to middle-performing and at-risk students. The latter category of students is less likely to consider college but may be more likely to change their attitudes about college attendance as a result of dual credit participation. The study results indicated that more under-represented minority and low-income students are taking advantage of the opportunity to participate in dual credit programs. Growth in dual credit programs was observed at the set of urban and suburban high schools where fewer students meet college ready standards. Based on the data, these schools are making dual credit programs available to students who meet eligibility standards, and students from different backgrounds participate at similar levels once enrolled. This information speaks to the practical significant of the ANOVA and descriptive data results. Getting more students ready for college-level courses and engaged in dual credit opportunities has the potential to greatly improve college readiness, enrollment, and success rates for the underserved populations that Texas is trying diligently to engage. However, more accurate and detailed data are needed to confirm the benefits to participating students.

Recommendations for Data Reporting

As noted throughout this study, availability of accurate data regarding student participation and outcomes is required to measure the success of dual credit programs. Quality data will also permit comparisons across programs and provide stronger tools to evaluate course rigor and quality. Clear, consistent data is a critical component of effective policy making. Improving and aligning dual credit data collection should be a top priority for the state. Aligned data will help facilitate appropriate program evaluation efforts, not only for estimating the overall effectiveness of dual credit programs, but also for monitoring individual programs to ensure that rules are followed and student needs are equitably served.

The availability of specific student-level course and performance data would greatly enhance dual credit data resources at the state level, provided that a means to identify dual credit participation is included. Research, evaluation, and monitoring capabilities would be greatly enhanced by the ability to track students' dual credit courses and grades, as well as their enrollment and performance in sequent college courses. Differences in performance by type of dual credit delivery and delivery location (for example, high school versus college campus) would be possible, as would comparisons of performance between traditional-aged college students and dual credit students who take the same course offerings. The ability to link performance data to instructors would also provide an excellent method for evaluating dual credit instructor quality.

Even without specific student-level course and performance data, adding a record or data element that could be used to link courses across the TEA and THECB systems should be a top priority when data reporting systems are next evaluated. Accurate alignment of student course records will result in more reliable information about dual credit course and program activities In Texas. Options for this data element might include required reporting of both the TEA service code and the THECB common course code when reporting dual credit courses in one or both systems. More specific recommendations for aligning courses in state-level data are included in the discussion of course crosswalks.

This study serves as a caution that data elements must be developed with care to avoid confusion. It also emphasizes the importance of using several sources to confirm research data. After surveying practitioners in the field and reviewing dual credit-related documents, several of the researcher's initial assumptions about the data proved to be incorrect. Through interviews and document collection and review, a better understanding of course reporting practices was gained and the researcher was able to select and characterize data for the study more accurately than would otherwise have been possible.

Course Crosswalks and Local Issues

Dual Credit Agreements and Interview Analysis

The dual credit agreement review conducted for this study consolidated information collected from dual credit partnership agreements received from over 90 percent of Texas public colleges and universities. The review provided evidence of private school and home school participation in dual credit programs, illustrated differences in student eligibility requirements across programs, and presented varied polices for maintaining rigor and quality in program content, instruction, and student evaluation. The language of the agreements and the policies contained within them reflected the state guidelines for dual credit programs and also highlighted local alignment challenges and "best practices." The agreements are themselves a testament to the collaboration necessary for offering a program that so directly involves both sectors. Administrative coordination, instructional practices, eligibility, funding, and course delivery models are a few of the issues that must be orchestrated for a dual credit program to function effectively.

In addition to the dual credit agreement reviews, interviews were conducted with 11 local high school and college dual credit coordinators and one state-level dual credit expert. The local coordinators provided insight about the dual credit populations at their schools, levels of student participation in academic and non-academic dual credit courses, changes in dual credit participation over time, AP and dual credit course identification, and issues relating to course rigor, quality, and access. Issues unique to rural dual credit programs were identified, as were several alignment concerns, such as differences in high school and college course schedules and the articulation problems students encounter when they enter college.

Dual Credit Crosswalk Analysis

Several of the partnership agreements provided specifics on how dual credit courses are "crosswalked." Crosswalk is a term used for the process of determining the specific high school course credit which will be awarded a student upon completion of a college course taken for dual credit. Several dual credit agreements included course crosswalk matrices for the dual credit offerings available through the institutional partners enacting the agreement. These listings, and information about course crosswalks from a dual credit survey administered by THECB in fall 2007, were used to conduct the course crosswalk analysis.

For the analysis, course crosswalks were tabulated and presented for four high-school-level academic subject areas: English, mathematics, science, and social studies. Results also included a frequency analysis of the high school courses most often offered for dual credit in Texas. While some high school courses were consistently linked to one or two college offerings, great variability was seen in other high school to college linkages.

The interviews conducted with high school and higher education dual credit coordinators provided additional insight into course crosswalks and the course content alignment process. The courses which showed the most variation in the crosswalk analysis were frequently those that were highlighted by the interviewees when they were queried about crosswalk policies and concerns. Straightforward linkages were not readily identifiable for all course offerings, and schools occasionally struggled to make appropriate connections between high school and college curricula. Mathematics and science courses raised particular challenges in this regard.

Independent Study Courses and Course Crosswalk Inconsistencies

The Texas Essential Knowledge and Skills (TEKS) state-wide curriculum provides “independent study” course codes for several academic disciplines. These course codes, which bear names like “special topics,” “scientific research and design,” and “independent study” were inconsistently used in the dual credit crosswalks. Some institutions used them to crosswalk college courses that do not readily fit existing high school course requirements; other institutions chose to match college courses to more specific, required high school courses even when the alignment was less obvious. Crosswalk decisions are influenced by many factors. Because Texas has rigorous coursework requirements for the recommended high school diploma program, students who get dual credit for specific graduation course requirements may have an advantage over those who are awarded credit for independent study courses within a discipline. Course weighting policies also affect course crosswalk determination. While TEA curriculum staff recommends independent study courses as appropriate for crosswalks, especially in science content areas, no official crosswalk guidelines are provided to schools.

Methods for Determining Crosswalks

Just as course crosswalks vary both within and across school districts and college service regions, so do methods for determining course linkages. While many of the dual credit agreements reviewed stated or implied that the determination of high school credits was the sole responsibility of the secondary-level partner, others agreements provided guidelines for aligning courses and prescribed high school to college collaborations to achieve this purpose. Interview participants also presented different perspectives on course crosswalk determination procedures that varied from very formal published crosswalks that were developed by cross-sector curriculum teams, to on-the-spot crosswalk determinations by a local high school principal.

The difficulties that sometimes surround the determination of course crosswalks illustrate the divides between the high school and higher education sectors. College faculty may pay little attention to high school course objectives or flatly refuse to teach dual credit courses if they must incorporate high school content. Institutions at both levels may struggle to link courses with misaligned content and feel uncomfortable with the results. If crosswalks are poorly designated, high school students may miss important content in the high school curriculum because of its exclusion from the college course. This may adversely affect student performance in the dual credit course or in subsequent college courses in the same or related disciplines.

Benefits of the Collaboration Process

Course crosswalks are a natural, propitious avenue for cross-sector collaboration between institutional representatives. The process of aligning coursework provides an excellent opportunity to discuss course objectives, materials, and goals. This type of interaction leads to better understanding of program content for instructional, administrative, and curriculum staff from both sides of the high-school-to-college transition. It also fosters conversations about student preparation and teacher expectations that benefit not only dual credit participants, but all students.

Recommendations for Course Crosswalks

More consistency is necessary in the development of crosswalks for dual credit courses. Improving consistency is particularly important given the exponential growth in dual credit programs statewide. Approaches that involve state intervention, local intervention, and a combination of the two should all be weighed for their advantages and drawbacks.

Any effort to evaluate crosswalks should include a careful review of the means by which TEA collects and reports dual credit course data. As noted previously, AP courses are considered high school courses and have unique assigned course codes in the TEA data system. Dual credit courses, on the other hand, must be linked with a high school course if high school credit is to be awarded. This requirement often results in dual credit course linkages which are not an appropriate fit with the college course content and objectives. Inconsistent crosswalk guidelines and crosswalk reporting structures lead to inaccurate or misleading data about student coursetaking activities.

One option for improving crosswalk alignment is to promote a change in the TEA reporting system. Commonly offered dual credit courses could be treated as AP courses are. Each course that passed a stringent review process would be given a unique course code in the TEA data system, making crosswalks unnecessary for reporting purposes.

Another option is to standardize course crosswalks for common dual credit offerings. Some states, such as Florida, have standardized the crosswalks between the high school and college curriculum (Hoffman et al., 2008). Florida, like Texas, has a very large dual credit population; statewide alignment helps ensure the quality of programs across the state. According to Hoffman (2008), having fewer, clearly defined courses available for dual credit makes it easier for states to maintain the quality of their programs. And while this level of specificity may not be best for Texas, the current variability in crosswalks has the potential to undermine the quality and equity of dual credit programs.

Standardized crosswalks for common dual credit courses would make it easier to monitor courses and provide assistance to course instructors. Course materials, syllabi, and other best practices could be shared. For less common courses, schools could continue to make their own determinations.

An alternative to standardized crosswalks is the development of state-level guidelines to use in this process. Several of the dual credit coordinators indicated an interest in such guidance for determining course crosswalks. Guidelines would help facilitate efforts to align courses and validate local crosswalk decisions.

Another option for addressing dual credit crosswalk misalignment is to require colleges, through rules or guidelines, to include course crosswalks in their dual credit partner agreements. The requirement would mandate a cross-sector review process to ensure that secondary institutions take the time to think through their crosswalk processes, collaborate with their higher education partners, and be consistent about how courses are linked within their school district. For research purposes, this option would provide a comprehensive mechanism to know, statewide, how courses are linked within each dual credit partnership.

A state-level crosswalk discussion should include guidelines for addressing the newly mandated state end-of-course tests which become part of the graduation requirements for high school freshmen in the 2011-2012 academic year. These tests will cover the TEKS contents of designated high school courses in foundation areas. Although the means are yet to be specifically determined, these tests will incorporate an evaluation of student college readiness. How this college readiness measure will be linked to dual credit participation must be carefully considered. If students are allowed to take dual credit courses in lieu of courses with end-of-course test requirements, school districts must ensure that such students are prepared for the end-of-course tests. Haphazard course alignment would jeopardize student performance and success on these assessments.

Secondary and Postsecondary Alignment Issues

Systems theory provides an excellent framework for examining the high school to college transition from an institutional perspective. To ensure that students make a smooth transition from high school to college, secondary and postsecondary systems must work in conjunction. Organizational experts assert that systems need to be open to interdependence if they are going to share functions. For one system to adapt or change, the other must change along with it (Haslam and Rubenstein, 2000). Systems approaches stress the importance of bridging and managing critical boundaries (Morgan, 1998), including those that are of a social, political, cultural, or administrative nature. Having common goals can facilitate better alignment across systems (Bolman & Deal), but navigating system differences is an important aspect of reaching those goals.

Organizational Couplings and Dual Credit Program Alignment

This study consistently identified the importance of K-12 and Higher Education system alignment issues. At some partner institutions, cross-sector relationships appeared to be loosely coupled and consist of few guidelines beyond those required by state regulation. Problems were addressed as they arose, and decisions about issues such as course crosswalks and schedule modifications were made on a case-by-case basis. At other partner institutions, tighter coupling appeared the norm, with extensive infrastructures and policies created to bridge gaps and support the program and partnership. Based on a general impression of combined interview responses, the dual credit coordinators interviewed agreed that considerable coordination within and among organizations is necessary to keep dual credit programs functioning successfully.

Recommendations for Sector Alignment

Closing achievement gaps and improving college readiness and success rates are primary objectives of educational reform. P-16 literature strongly indicates that alignment across secondary and postsecondary sectors is critical in reaching these educational goals, especially for a larger and more inclusive group of students. The analysis of dual credit courses provides an excellent window into important processes that occur at the high school-to-college transition. While aspects of this study illustrated the challenges of secondary and postsecondary alignment, the study also provides strong support for the value of the efforts to date, some of which have already reaped a substantial harvest.

In order to reach the full potential of dual credit programs, effective communication is a critical ingredient. Communication is essential not only across sectors, but also with the students and parents who navigate these sectors. Schedules must be adjusted, syllabi compared, teachers and students evaluated, and problems addressed. Expectations for student and instructor performance must also be explored and aligned.

The need for K-12 and Higher Education collaboration is as important at the state level as at the institutional partner level. Bodies such as the statewide P-16 Council provide a means for state and regional stakeholders to explore issues such as dual credit from multiple perspectives. Staff members from TEA and THECB must work closely together to ensure that each agency's programs and policies are understood and aligned.

The statewide network of regional P-16 councils should be encouraged to focus attention on dual credit activities and participate in discussions about effective program growth and alignment. Dual credit is a model for collaboration that has been sustained for many years by district and college partners. It provides an opportunity locally for putting P-16 ideas into practice. Regional and state P-16 groups can learn from the past mistakes and achievements of these collaborations and gain a stronger understanding of the challenges inherent in P-16 alignment efforts.

Balancing Dual Credit Tensions in Texas

The needs of all stakeholders must be incorporated into state-level discussions of dual credit policy. Students, parents, teachers, school districts, communities, colleges and universities, and the State benefit from successful deployment of dual credit programs. The results of this study, however, point to two overarching and critical areas of tension that must be considered by state policy makers and other stakeholders regarding dual credit programs. These areas of tension have been identified by dual credit researchers as dual credit programs expand in size and scope: quality/rigor versus access and flexibility versus consistency/control (Kim et al., 2003).

Quality/Rigor versus Access

Despite some recent progress, college enrollment and access rates for traditionally under-represented groups still lag behind those of enrollees from traditional groups. This continuing reality has prompted Texas to expand its efforts to increase the college-going rates for Hispanic, African American, and low income students. The findings of this study showed increased participation in dual credit programs across the state for these groups. Hispanic, African American, and low income student participation has increased in both number and proportion of total participants. Dual credit participation grew in urban and suburban high school districts where the majority of the population is not considered "college ready" based on state readiness measures. And school districts of all types continue to strive to provide college-level opportunities for students who meet eligibility requirements.

Dual credit programs provide an excellent pathway for underrepresented students to benefit from the rigors of college work. However, dual credit programs must strike a delicate balance between access and quality. As more students enroll in dual credit programs, standards run the risk of being lowered as needed instructors and courses are added. Given the movement toward encouraging middle-performing and at-risk students to participate in dual credit programs, it is vital for programs to be expanded carefully to ensure that students get the support, rigor, and "authentic" college experience necessary for success.

Research shows that students benefit from rigorous high school coursework and exposure to college course experiences (Adelman, 1999, 2006 Nakkula & Foster, 2007 Karp, 2006). If greater access to dual credit programs is achieved without maintaining quality, no students are well-served: higher education admission officials who see dual credit courses on a transcript will not have confidence in what those courses represent, and enrolling college freshmen will feel discouraged when they find they are under-prepared despite their dual credit efforts. However, increasing access to dual credit programs does not mean that program quality must suffer. In order to accomplish this objective, efforts to adapt to rapid growth and changing student populations must be met with clearly established strategies for maintaining rigor. Better program monitoring at the state and local levels can improve outcomes, as can strengthening instructor training and student support. While program growth may make it more difficult for colleges to monitor programs, it also makes it vital that they do so.

Flexibility versus Consistency/Control

This study demonstrates that there is significant variation in the implementation of dual credit programs around the state of Texas. While THECB provides guidelines through dual credit rules, colleges and their partner high schools have significant flexibility in how they structure dual credit programs. Little state-level monitoring/auditing of these programs has been attempted, and the contents of dual credit agreements indicate considerable differences in local oversight of the programs. Flexibility can lead to innovation and the ability to respond to individual student and school needs. Often best practices emerge when institutions have the leeway to improvise solutions. Conversely, while too much regulation can lead to stagnation and unnecessary red tape, appropriate guidelines can also provide needed controls. This study provides considerable evidence that there is a clear need for more consistency in dual credit crosswalk development, dual credit reporting, and dual credit monitoring.

Recommendations for Balancing Dual Credit Tensions

To maintain program quality, state level decision-makers in Texas must work to ensure that some of the very effective innovations and efforts taking place in isolated dual credit programs around the state are disseminated, and that a clear mechanism for communication between colleges is provided. As programs grow, it will become increasingly critical for schools to implement thoughtful policies and practices for dual credit programs, as well as for the state to ensure those practices fall within the spirit and the intention of the dual credit rules and guidelines. Along with increased monitoring, efforts to provide financial, instructional, or other supports to schools that are struggling to improve program quality and access is recommended. A website with best practices or a listserv for dual credit coordinators could help unite the growing number of teachers and administrators who support dual credit programs.

This study highlights the need for additional state-wide intervention in dual credit activities. But increased state-level involvement must include feedback from the people and institutions that coordinate and offer dual credit programs around the state. Tensions between consistency and flexibility will only be heightened if institutions and other stakeholders do not actively participate in the process. A committee to discuss dual credit alignment, monitoring, and quality issues would provide helpful feedback to state-level policy-makers and should include not only high level district and college personnel, but also individuals who work closely with dual credit students and programs, including faculty members who teach dual credit courses. A great deal of practical experience is available in Texas which could be harnessed to increase understanding about dual credit programs and motivate educators to continue to strengthen their efforts to use the programs for the good of a wide range of students.

Ideas for Future Research

This study points to related research opportunities to advance understanding of the impact of dual credit coursetaking. Future research is needed on student outcomes that incorporates student-level performance data such as course grades and assessment results and adjusts for the selectivity factor which is built into the system through eligibility requirements. A statewide survey of current students participating in dual credit coursework would provide insight into student perceptions of program quality and accessibility. A study of the use of dual credit to augment home schooling would supply needed information about this difficult-to-monitor group. And a qualitative follow-up study of college students who participated in dual credit programs while in high school would provide a different perspective on program strengths and weaknesses. Students could be questioned about the impact of dual credit experiences on their college aspirations and overall academic readiness for college-level coursework.

The impact of dual credit on student aspirations and readiness is an important area of inquiry, especially now that dual credit is reaching different and more diverse populations than in the past. An in-depth study of how dual credit opportunities influence the college pathways of at-risk and traditionally underrepresented students would be a meaningful addition to the literature. In fact, given the regional differences in dual credit participation across Texas, a state-wide study that takes a focused look at how dual credit participation impacts at-risk and underrepresented students from different regions would be of value.

Also of value would be a study of dual credit best practices across the state. Because dual credit programs have developed locally and vary from region to region, practitioners could benefit from a survey or other exploration of what practices are working for dual credit programs and students.

Finally, there is serious need for research on dual credit funding in Texas. Not surprisingly, funding mechanisms for dual credit programs vary around the state and employ differing models and approaches. A close look at funding issues would help to ensure that the state and its citizens are getting good value for their money. Any such research should consider the importance of equity and ethics in approaches to funding dual credit programs.

Concluding Thoughts

Dual credit programs span high school-to-college boundaries and serve to highlight the importance of cross-sector alignment. Rapidly growing and evolving programs and participation rates in Texas have heightened awareness of inconsistencies in dual credit policies and practices. The findings of this research indicate a need for more consistent and aligned dual credit data reporting requirements at the state level, standards for aligning high school and college courses and determining dual credit course crosswalks, closer state and local monitoring of dual credit programs to ensure quality, and a state-level effort to bring together state, regional, and local dual credit stakeholders to discuss appropriate means to achieve these recommendations.

For K-12 institutions, postsecondary institutions, and state agencies there is a fine line between independence and interdependence with regard to P-16 issues. Attention must be paid to how reform efforts are integrated across levels and sectors. For dual credit programs, local partners need the flexibility to explore creative ways to engage and support a wide-range of dual credit participants while maintaining the college-level nature of the course experience. The state must ensure that dual credit opportunities meet acceptable levels of both rigor and equity for all Texas students by providing guidelines for consistent practice. If state and local efforts to provide quality, equity, and access are unsuccessful, the integrity of the programs -- and of a college degree -- will be compromised. Dual credit programs appropriately blur the lines of age. They should not blur the lines of expectations.

APPENDIX A

Table A1 **Interview Questions**

Interview Questions for College Experts

1. What is your role at the institution where you work?

2. What types of dual credit courses does your institution offer?
   a. Do you offer Dual Credit/AP overlay?
   b. What percent of the courses offered are technical/tech prep/"non-academic" (define for participant)

3. Do many students take dual credit courses in the summer?

4. Are there transcription/articulation issues associated with the summer courses? What about the regular semester courses?

5. Are you involved with reporting aspects of dual credit programs?
   a. If so, how does your institution report courses taken by high school students when the course is not for dual credit? Is it easy to distinguish between courses taken for dual credit and those that are not?
   b. What are some of the other reporting issues that you face, if any?

6. Is it easy or difficult to create course crosswalks between the college courses at your institution and the high school courses for which a student will receive dual credit?

7. Are the reporting and course crosswalk systems similar for all of the high schools that participate in dual credit programs at your institution?

8. Do you perceive differences between the student populations that take academic dual credit and non-academic dual credit at your institution?

9. Have the populations of students who take dual credit courses changed over time? If so, in your opinion, has this been a positive or negative phenomenon?

10. Do you have any other comments to add about the statewide reporting of dual credit courses and dual credit course crosswalks?

Table A1 (cont.)

Interview Questions for High School Experts

1. What is your role at the institution where you work?

2. What types of dual credit courses does your school offer through dual credit agreement?
    a. Are the courses offered on the high school campus, the college campus, or both?
    b. Do you offer Dual Credit/AP overlay?
    c. What percent (approximately) of the courses offered on the high school campus are technical/tech prep/"non-academic?"

3. Do many students take dual credit courses in the summer? When and how are those reported through the PEIMS system?

4. Are there transcription and/or articulation issues associated with the summer courses? What about regular semester courses?

5. Are you involved with reporting aspects of dual credit programs?
    a. If so, do you think that dual credit definitions are clear in the reporting system?
    b. Are there any reporting issues that you are aware of?

6. Is it easy or difficult to create course crosswalks between the college courses at your institution and the high school courses for which a student will receive dual credit?

7. Do you perceive differences between the student populations that take academic dual credit and non-academic dual credit? Do you feel that the students who take dual credit on the high school campus different are different in any way than those who take dual credit on the college campus?

8. Have the populations of students who take dual credit courses changed over time? If so, in your opinion, has this been a positive or negative phenomenon?

9. Do you have any other comments to add about the statewide reporting of dual credit courses and dual credit course crosswalks?

Table A2

2004-2007 Texas Public High School Graduates
Frequency of Dual Credit Courses Taken by Course Title

Crs. Code	Course Title	2004	2005	2006	2007	Grand Total
Grand Total		52,219	55,315	61,957	72,762	242,253
03220400	ENGLISH IV (ENG 4)	10,023	10,825	11,766	13,717	46,331
03330100	UNITED STATES GOVERNMENT (GOVT	5,492	6,506	7,050	8,643	27,691
03310300	ECONOMICS W/EMPH FREE ENTERPR	3,675	4,338	4,976	5,818	18,807
03340100	US HISTORY SINCE RECONSTRUCTIO	3,309	3,157	3,984	4,653	15,103
A3220200	ENGLISH LIT AND COMPOSITION	3,133	3,380	4,096	3,945	14,554
A3340100	UNITED STATES HISTORY-APUSHIST	2,459	2,834	3,160	3,079	11,532
03101100	PRECALCULUS (PRE CALC)	2,105	2,586	2,740	3,194	10,625
A3220100	ENGLISH LANG AND COMPOSITION	1,389	1,650	2,017	2,257	7,313
A3330100	US GOVERNMENT AND POLITICS	1,442	1,612	1,956	1,767	6,777
03220300	ENGLISH III (ENG 3)	1,644	1,373	1,429	1,629	6,075
A3100101	CALCULUS AB (APCALCAB)	904	1,061	974	1,085	4,024
A3010200	BIOLOGY (AP-BIO)	978	974	1,047	980	3,979
12011200	BUS COMP INFO SYS I (BEGBCIS1)	1,315	836	771	729	3,651
03350100	PSYCHOLOGY (PSYCH)	693	786	864	1,118	3,461
03102500	INDEP STUDY IN MATH (1ST TIME)	614	704	860	1,139	3,317
03440300	LANG O/T ENGLISH III - SPANISH	687	728	828	978	3,221
03370100	SOCIOLOGY (SOC)	393	451	532	589	1,965
A3310200	MACROECON (1/2 UNIT)(APMACECO)	312	444	497	624	1,877
1201120T	BUS COMP INFO SYS I (BCIS1-TP)	131	227	526	988	1,872
12112130	ANATOMY/PHYSIOLOGY HUMAN SYSTM	395	362	392	553	1,702
03241400	COMMUNICATION APPLICATIONS	311	307	381	585	1,584

2004-2007 Texas Public High School Graduates
Frequency of Dual Credit Courses Taken by Course Title (cont.)

Crs. Code	Course Title	2004	2005	2006	2007	Grand Total
12031300	BUS COMP INFO SYS II ADVBCIS1	241	300	433	480	1,454
A3310100	MICROECON (1/2 UNIT)(APMICECO)	318	279	360	418	1,375
1203130T	BUS COMP INFO SYS II ABCIS-TP	173	260	341	576	1,350
1234147T	COMPUTER APPLICATIONS (CA-TP)	123	305	346	557	1,331
A3100102	CALCULUS BC (APCALCBC)	290	307	317	417	1,331
A3440100	LANG O/T ENGLISH IV-AP SPANISH	217	342	336	296	1,191
03221600	HUMANITIES (HUMANIT)	131	187	339	287	944
03380001	SOCIAL STUDIES ADV (1ST TIME)	222	271	195	189	877
A3350100	PSYCHOLOGY (APPSYCH)	200	196	201	219	816
03100600	ALGEBRA II (ALG2)	213	163	184	252	812
03102501	INDEP STUDY IN MATH (2ND TIME)	135	187	163	285	770
1202210T	ACCOUNTING I (BACCT-TP)	59	142	233	292	726
122T4210	NUTRITION & FOOD SCI NFSCI-TP	88	183	292	152	715
03221800	INDEP STUDY/ENGLISH (1ST TIME)	209	106	142	234	691
A3040000	CHEMISTRY (AP-CHEM)	195	166	140	131	632
12101500	HLTH SCI TECH III (HSTIII)	65	46	206	288	605
03380002	SPEC TOPIC IN SOC STUD (1ST)	108	156	137	181	582
03040000	CHEMISTRY (CHEM)	64	161	169	181	575
A3100200	AP STATISTICS (APSTATS)	59	111	210	188	568
03010200	BIOLOGY (BIO)	103	122	144	195	564
12579102	AUTOMOTIVE TECHNICIAN I	111	129	142	170	552
12568708	TECH INTRO TO CRIMINAL JUSTICE	199	135	99	83	516
03440400	LANG O/T ENGLISH IV - SPANISH	104	122	141	127	494

Crs. Code	Course Title	2004	2005	2006	2007	Grand Total
03050000	PHYSICS (PHYSICS)	222	71	91	108	492
1210140T	HLTH SCI TECH II (HSTII-TP)	48	69	119	248	484
03241300	SPEECH COMMUNICATION (SP COM)	114	95	133	125	467
03100500	ALGEBRA I (ALG 1)	142	157	85	59	443
1210130T	HLTH SCI TECH I (HSTI-TP)	43	78	102	176	399
122T3310	CHILD DEVELOPMENT (CHDEV-TP)	43	39	93	207	382
12055300	WBL/BUSINESS COMP INFO SYS II	52	98	115	116	381
03580200	COMPUTER SCIENCE I (TACS1)	115	75	61	111	362
12568704	CRIME IN AMERICA (CAM)	139	78	93	41	351
12011500	KEYBOARDING (KEYBRDG)	198	59	56	36	349
A3440200	LANG O/T ENG V LIT-AP SPANISH	109	89	48	96	342
12204210	NUTRITION AND FOOD SCIENCE	7	39	10	280	336
03060201	INTEGRATED PHYSICS/CHEMISTRY	68	133	132	2	335
03221100	RESEARCH/TECHNICAL WRITING	98	95	66	72	331
A3330200	COMPARAT GOV & POL (APCPGOVT)	81	67	90	76	314
03820101	PHYS EDUC 1A FOUNDATIONS FIT	230	28	20	22	300
12101400	HLTH SCI TECH II (HSTII)	95	43	74	86	298
12022100	ACCOUNTING I (BEGACCT1)	64	67	76	79	286
12101300	HLTH SCI TECH I (HSTI)	86	90	56	52	284
A3500100	HISTORY OF ART (APHISART)	50	70	83	68	271
12121220	MEDICAL TERMINOLOGY (MEDTERM)	33	80	77	79	269
03221200	CREATIVE/IMAGINATIVE WRITING	69	60	59	71	259
125687T8	TEC INTO CRIME JUSTICE TICJ-TP		54	98	95	247
03310301	ECONOMICS ADV STUDIES (1ST)	56	90	51	47	244
N1295006	INTERNETWORKING TECH I	94	64	52	30	240
03501700	ART III HISTORY (ART3HIST)	35	63	73	65	236
12203310	CHILD DEVELOPMENT (CHLD-DEV)	80	37	39	79	235

2004-2007 Texas Public High School Graduates (cont.)
Frequency of Dual Credit Courses Taken by Course Title

Crs. Code	Course Title	2004	2005	2006	2007	Grand Total
1202230T	BUS IMG MGT&MULTIM (BIM&M-TP)	25		35	167	227
03580800	WEB MASTERING (TAWEBMAS)	99	27	9	76	211
03850104	INDIVIDUAL SPORTS (1ST TIME)	50	66	39	54	209
A3050001	PHYSICS B (AP-PHYSB)	81	46	8	73	208
12557901	WELDING I (WLDNG)	43	50	48	66	207
03152900	MUSIC I HISTORY (MUS1HIST)	35	43	75	53	206
03221500	LITERARY GENRES (LIT GENR)	63	12	49	79	203
03440200	LANG O/T ENGLISH II - SPANISH	67	33	39	58	197
03240900	PUBLIC SPEAKING I (PUBSPKG1)	84	32	29	51	196
12022300	BUS IMG MGT&MULTIM (BUSIM/MM)	86	14	29	67	196
12112120	SCIENTIFIC RESEARCH & DESIGN I	43	32	23	97	195
03810100	HEALTH EDUCATION (HLTH ED)	30	81	32	48	191
12578903	AIRCRAFT MECHANICS I (ACRFTMCH	48	49	51	39	187
03340400	WORLD HISTORY STUDIES (W HIST)	131	16	14	25	186
03320100	WORLD GEOGRAPHY STUDIES (W GEO	120	57	4	4	185
03221810	INDEP STUDY/ENGLISH (2ND TIME)	45	6	28	103	182
1236268T	COMP MULTIM & AN TECH CMAT-TP	15	35	69	61	180
03220100	ENGLISH I (ENG 1)	92	68	5	14	179
1212122T	MEDICAL TERMINOLOGY (MDTRM-TP)	16	32	55	71	174
12579103	AUTOMOTIVE TECHNICIAN II	13	24	51	81	169
03850124	INDIVIDUAL SPORTS (3RD TIME)	45	31	43	48	167
03410200	LANG O/T ENGLISH II - FRENCH	160	2		3	165
03860105	TEAM SPORTS (FIRST TIME)	30	21	48	65	164
03980200	LANG O/T ENGLISH II - ASL	62	47	34	17	160

2004-2007 Texas Public High School Graduates (cont.)
Frequency of Dual Credit Courses Taken by Course Title

Crs. Code	Course Title	2004	2005	2006	2007	Grand Total
03500100	ART I (ART 1)	25	40	42	48	155
03221300	PRACTICAL WRITING SKILLS	27	69	34	24	154
12579301	AUTO COLLISION REPAIR TECH I	22	33	49	48	152
12568707	FUNDAMENTALS OF CRIMINAL LAW	68	50	23	9	150
N1290010	STUDENT LEADERSHIP (STULEAD)	32	46	29	43	150
12534502	COMP MNT TECHNICIAN I CTRMTN	31	15	44	59	149
03420300	LANG O/T ENGLISH III - GERMAN	31	38	40	34	143
A3580100	COMPUTER SCIENCE I (APTACS1)	33	28	28	54	143
125117T1	ENGINEERING CAD I (ECAD-TP)	28	41	23	50	142
N1236209	INFO TECH APPLICATION I (ITAI)	47	26	38	29	140
03380021	SOCIAL STUDIES ADV (2ND TIME)	12	29	44	53	138
122T4310	FOOD SCIENCE & TECH (FST-TP)	12	32	59	34	137
03430300	LANG O/T ENGLISH III - LATIN	32	30	21	53	136
12568101	COSMETOLOGY I (CSMT)	31	29	42	34	136
03310321	ECONOMICS ADV STUDIES (2ND)	40	38	52	5	135
12031400	BUS COMP PROGRAMMING (ADVBCP1)	23	7	63	42	135
03380003	SOC STUD RESEARCH METH (1ST)	3	43	66	20	132
03440100	LANG O/T ENGLISH I - SPANISH	52	9	18	52	131
12512101	DRAFTING I (DRFT)	76	6	16	27	125
N1242045	PRIN OF REAL ESTATE (PRREALES)	29	41	20	30	120
03410100	LANG O/T ENGLISH I - FRENCH	108	4		3	115
03980100	LANG O/T ENGLISH I - ASL	55	38	17	5	115
12055200	WBL/ADMINISTRATIVE PROCEDURES	22	18	33	42	115
03410300	LANG O/T ENGLISH III - FRENCH	27	31	26	29	113

2004-2007 Texas Public High School Graduates (cont.)
Frequency of Dual Credit Courses Taken by Course Title

Crs. Code	Course Title	2004	2005	2006	2007	Grand Total
12204310	FOOD SCIENCE AND TECHNOLOGY	2	29	4	78	113
A3410100	LANG O/T ENG IV LANG-AP FRENCH	23	31	21	38	113
N1295007	INTERNETWORKING TECH II	34	30	18	31	113
03820501	PHYS ED EQUIVALENT-1 (PE EQ1)	30	19	21	41	111
N1295004	CAREERS IN EDUCATION II (CIEII	46	37	21	3	107
03060000	GEOLOGY METEOROLOGY OCEANOGR	18	25	28	32	103
12578904	AIRCRAFT MECHANICS II ACRFTMC2	28	25	29	21	103
12421055	TRAVEL AND TOURISM MARKETING	32	32	17	21	102
03220200	ENGLISH II (ENG 2)	67	14	5	14	100
12203210	PREP FOR PARENTING (PREP-PAR)	40	8	15	36	99
12511701	ENGINEERING CAD I (ECAD)	25	15	35	24	99
03380022	SPEC TOPIC IN SOC STUD (2ND)	16	28	31	23	98
N122T501	CULINARY ARTS I (CUL1-TP)	5	24	35	31	95
12061100	BUSINESS ED INDEP STUDY I	25	19	15	35	94
12522703	BUILDING TRADES I (BLDGTR)	30	36	14	14	94
12510903	ADVERTIS DESIGN III (ADVDSGN3)	27	22	20	21	90
N1290003	BRIDGING EDUCATIONAL SCENE 1	21	11	25	32	89
12022700	TELECOMM & NETWORK (TELE/NET)	24	20	7	36	87
03440500	LANG O/T ENGLISH V - SPANISH	14	17	29	24	84
03580700	VIDEO TECHNOLOGY (TAVIDTEC)	7		1	74	82
03840103	AEROBIC ACTIVITIES (1ST TIME)	30	29	10	13	82
N1220307	READY SET TEACH! I (TEACH-I)	13	17	20	32	82

2004-2007 Texas Public High School Graduates (cont.)
Frequency of Dual Credit Courses Taken by Course Title

Crs. Code	Course Title	2004	2005	2006	2007	Grand Total
12362620	ARCHITECTURAL GRAPHICS (AG)	18	6	18	39	81
03150400	MUSIC IV BAND (MUS4BAND)	21	22	18	19	80
12511702	ENGINEERING CAD II (ECAD2)	21	17	20	22	80
03420200	LANG O/T ENGLISH II - GERMAN	4	14	34	26	78
03820502	PHYS ED EQUIVALENT-2 (PE EQ2)	19	10	20	29	78
N1295TC6	INTERNTWRKING TECH I INNTC1TP	28	20	18	12	78
03241000	PUBLIC SPEAKING II (PUBSPKG2)	13	27	22	15	77
03020000	ENVIRONMENTAL SYSTEMS-ENVIRSYS	58	7	3	8	76
1236267T	ELECTRIC/ELECTRON TECH EET-TP	7	19	24	26	76
12579106	AUTOMOTIVE TECHNICIAN III	14	21	20	21	76
122T3210	PREP FOR PARENTING (PRPAR-TP)	19	15	17	24	75
12441140	MARKETING DYNAMICS (MKTDYN)	4		2	69	75
12568702	CORRECTIONAL SYS AND PRACTICES	34	35	4	2	75
N122T309	EXPLOR EDUC CAREERS EXPED-TP	37	35	3		75
Varied	399 Courses With Fewer than 75 Enrollments Each	1,614	1,509	1,501	2,735	7,359

Table A3 Dual Credit Course Enrollments with Over 150 Students

2004-2007 Texas Public High School Graduates (English, Math, Social Studies, Science)

Subject:	**English**	**High School Graduation Year**				
Crs Code		**2,004**	**2,005**	**2,006**	**2,007**	**Total**
03220400	ENGLISH IV (ENG 4)	10,023	10,825	11,766	13,717	46,331
A3220200	AP ENGLISH LIT AND COMPOSITION	3,133	3,380	4,096	3,945	14,554
A3220100	AP ENGLISH LANG AND COMPOSITION	1,389	1,650	2,017	2,257	7,313
03220300	ENGLISH III (ENG 3)	1,644	1,373	1,429	1,629	6,075
03241400	COMMUNICATION APPLICATIONS	311	307	381	585	1,584
03221600	HUMANITIES (HUMANIT)	131	187	339	287	944
03221800	INDEP STUDY/ENGLISH (1ST TIME)	209	106	142	234	691
03241300	SPEECH COMMUNICATION (SP COM)	114	95	133	125	467
03221100	RESEARCH/TECHNICAL WRITING	98	95	66	72	331
03221200	CREATIVE/IMAGINATIVE WRITING	69	60	59	71	259
03221500	LITERARY GENRES (LIT GENR)	63	12	49	79	203
03240900	PUBLIC SPEAKING I (PUBSPKG1)	84	32	29	51	196
03221810	INDEP STUDY/ENGLISH (2ND TIME)	45	6	28	103	182
03220100	ENGLISH I (ENG 1)	92	68	5	14	179
03221300	PRACTICAL WRITING SKILLS	27	69	34	24	154
	English Total	**17,432**	**18,265**	**20,573**	**23,193**	**79,463**

Subject:	**Math**					
Crs Code		**2,004**	**2,005**	**2,006**	**2,007**	**Total**
03101100	PRECALCULUS (PRE CALC)	2,105	2,586	2,740	3,194	10,625
A3100101	CALCULUS AB (APCALCAB)	904	1,061	974	1,085	4,024
03102500	INDEP STUDY IN MATH (1ST TIME)	614	704	860	1,139	3,317
A3100102	CALCULUS BC (APCALCBC)	290	307	317	417	1,331
03100600	ALGEBRA II (ALG2)	213	163	184	252	812
03102501	INDEP STUDY IN MATH (2ND TIME)	135	187	163	285	770
A3100200	AP STATISTICS (APSTATS)	59	111	210	188	568
03100500	ALGEBRA I (ALG 1)	142	157	85	59	443
	Math Total	**4,462**	**5,276**	**5,533**	**6,619**	**21,890**

Dual Credit Course Enrollments with Over 150 Students
2004-2007 Texas Public High School Graduates (Continued)

Subject:	Social Studies					
Crs Code		**2,004**	**2,005**	**2,006**	**2,007**	**Total**
03330100	UNITED STATES GOVERNMENT (GOVT	5,492	6,506	7,050	8,643	27,691
03310300	ECONOMICS W/EMPH FREE ENTERPR	3,675	4,338	4,976	5,818	18,807
03340100	US HISTORY SINCE RECONSTRUCTIO	3,309	3,157	3,984	4,653	15,103
A3340100	UNITED STATES HISTORY-APUSHIST	2,459	2,834	3,160	3,079	11,532
A3330100	US GOVERNMENT AND POLITICS	1,442	1,612	1,956	1,767	6,777
03350100	PSYCHOLOGY (PSYCH)	693	786	864	1,118	3,461
03370100	SOCIOLOGY (SOC)	393	451	532	589	1,965
A3310200	MACROECON (1/2 UNIT)(APMACECO)	312	444	497	624	1,877
A3310100	MICROECON (1/2 UNIT)(APMICECO)	318	279	360	418	1,375
03380001	SOCIAL STUDIES ADV (1ST TIME)	222	271	195	189	877
A3350100	PSYCHOLOGY (APPSYCH)	200	196	201	219	816
03380002	SPEC TOPIC IN SOC STUD (1ST TIME)	108	156	137	181	582
A3330200	COMPARAT GOV & POL (APCPGOVT)	81	67	90	76	314
03340400	WORLD HISTORY STUDIES (W HIST)	131	16	14	25	186
03320100	WORLD GEOGRAPHY STUDIES (W GEO	120	57	4	4	185
	Social Studies Total	**18,955**	**21,170**	**24,020**	**27,403**	**91,548**

Subject:	Science					
Crs. Code		**2,004**	**2,005**	**2,006**	**2,007**	**Total**
A3010200	BIOLOGY (AP-BIO)	978	974	1,047	980	3,979
A3040000	CHEMISTRY (AP-CHEM)	195	166	140	131	632
03040000	CHEMISTRY (CHEM)	64	161	169	181	575
03010200	BIOLOGY (BIO)	103	122	144	195	564
03050000	PHYSICS (PHYSICS)	222	71	91	108	492
03060201	INTEGRATED PHYSICS/CHEMISTRY	68	133	132	2	335
A3050001	PHYSICS B (AP-PHYSB)	81	46	8	73	208
	Science Total	**1,711**	**1,673**	**1,731**	**1,670**	**6,785**

Table A4

AP and IB Enrollments in Dual Credit Courses (by Course Code and Title)
2004-2007 Texas Public High School Graduates

Crs Code	Course Title	Year of High School Graduation 2004	2005	2006	2007	Grand Total
A3220200	ENGLISH LIT AND COMPOSITION	3,133	3,380	4,096	3,945	14,554
A3340100	UNITED STATES HISTORY-APUSHIST	2,459	2,834	3,160	3,079	11,532
A3220100	ENGLISH LANG AND COMPOSITION	1,389	1,650	2,017	2,257	7,313
A3330100	US GOVERNMENT AND POLITICS	1,442	1,612	1,956	1,767	6,777
A3100101	CALCULUS AB (APCALCAB)	904	1,061	974	1,085	4,024
A3010200	BIOLOGY (AP-BIO)	978	974	1,047	980	3,979
A3310200	MACROECON (1/2 UNIT)(APMACECO)	312	444	497	624	1,877
A3310100	MICROECON (1/2 UNIT)(APMICECO)	318	279	360	418	1,375
A3100102	CALCULUS BC (APCALCBC)	290	307	317	417	1,331
A3440100	LANG O/T ENGLISH IV-AP SPANISH	217	342	336	296	1,191
A3350100	PSYCHOLOGY (APPSYCH)	200	196	201	219	816
A3040000	CHEMISTRY (AP-CHEM)	195	166	140	131	632
A3100200	AP STATISTICS (APSTATS)	59	111	210	188	568
A3440200	LANG O/T ENG V LIT-AP SPANISH	109	89	48	96	342
A3330200	COMPARAT GOV & POL (APCPGOVT)	81	67	90	76	314
A3500100	HISTORY OF ART (APHISART)	50	70	83	68	271
A3050001	PHYSICS B (AP-PHYSB)	81	46	8	73	208
A3580100	COMPUTER SCIENCE I (APTACS1)	33	28	28	54	143
A3410100	LANG O/T ENG IV LANG-AP FRENCH	23	31	21	38	113
A3020000	ENVIRONMENTAL SCIENCE	16	10	18	28	72
I3220400	ENGLISH IV (IBENG 4)	1	4	14	41	60
A3150200	MUSIC THEORY 1 UNIT (APMUSTHY)	5	6	13	33	57
A3420100	LANG O/T ENG IV LANG-AP GERMAN	19	6	14	12	51
A3500300	ART/DRAWING (APSTARTD)	1			50	51
A3430100	LANG O/T ENG IV (LATIN-VERGIL)	4	15	12	16	47
A3410200	LANG O/T ENG V LIT - AP FRENCH	10	14	7	13	44
A3050002	PHYSICS C (AP-PHYSC)		6	9	28	43
A3220300	INTERNATIONAL ENGLISH LANGUAGE	34	7		1	42
A3340200	EUROPEAN HISTORY (APEUHIST)	20	12		3	35
A3580200	COMPUTER SCIENCE II (APTACS2)	6	3		21	30
I3100300	MATHEMATICS HIGHER LEVEL		4	5	15	24
I3600100	ART/DESIGN HL (IBARTHL)		11	10		21
	AP & IB Courses with less than 20 Enrollments	23	10	29	27	89
Grand Total		**12,412**	**13,795**	**15,720**	**16,099**	**58,026**

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